No. 23-1501, -1554

IN THE
United States Court of Appeals for the Federal Circuit

APPLE INC.,

Appellant,

LG ELECTRONICS INC., LG ELECTRONICS USA, INC., GOOGLE LLC,

Appellees,

v.

GESTURE TECHNOLOGY PARTNERS LLC,

Cross-Appellant.

On Appeal from the United States Patent and Trademark Office,
Patent Trial and Appeal Board
Nos. IPR2021-00921, IPR2022-00092, and IPR2022-00362

OPENING BRIEF OF APPELLANT APPLE INC.

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CLAIM LANGUAGE AT ISSUE

U.S. Patent No. 8,878,949, Claims 1, 4, 8, 11, 13, 18

1. A portable device comprising:

> a device housing including a forward-facing portion, the forward facing portion of the device housing encompassing an electro-optical sensor … and including a digital camera separate from the electro-optical sensor …

4. The portable device of claim 1 wherein the electro-optical sensor is fixed in relation to the digital camera.

8. A computer implemented method comprising:

> providing a portable device including a forward facing portion encompassing a digital camera and an electro-optical sensor …

11. The method according to claim 8 wherein the electro-optical sensor includes first and second sensors in fixed relation relative to the digital camera.

13. An image capture device comprising:

> a device housing including a forward facing portion, the forwarding facing portion encompassing a digital camera … and encompassing a sensor …

18. The image capture device of claim 13 wherein the sensor is fixed in relation to the digital camera.

UNITED STATES COURT OF APPEALS
FOR THE FEDERAL CIRCUIT

CERTIFICATE OF INTEREST

Case Number 23-1501, -1554

Short Case Caption Apple Inc. v. Gesture Technology Partners, LLC

Filing Party/Entity Apple Inc.

Instructions:

1. Complete each section of the form and select none or N/A if appropriate.
2. Please enter only one item per box; attach additional pages as needed, and check the box to indicate such pages are attached.
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I certify the following information and any attached sheets are accurate and complete to the best of my knowledge.

Date: 08/07/2023 Signature: /s/ Robbie Manhas

Name: Robbie Manhas

1. Represented Entities. Fed. Cir. R. 47.4(a)(1).	**2. Real Party in Interest.** Fed. Cir. R. 47.4(a)(2).	**3. Parent Corporations and Stockholders.** Fed. Cir. R. 47.4(a)(3).
Provide the full names of all entities represented by undersigned counsel in this case.	Provide the full names of all real parties in interest for the entities. Do not list the real parties if they are the same as the entities. ☑ None/Not Applicable	Provide the full names of all parent corporations for the entities and all publicly held companies that own 10% or more stock in the entities. ☑ None/Not Applicable
Apple Inc.		

☐ Additional pages attached

4. Legal Representatives. List all law firms, partners, and associates that (a) appeared for the entities in the originating court or agency or (b) are expected to appear in this court for the entities. Do not include those who have already entered an appearance in this court. Fed. Cir. R. 47.4(a)(4).

☑ None/Not Applicable ☐ Additional pages attached

5. Related Cases. Other than the originating case(s) for this case, are there related or prior cases that meet the criteria under Fed. Cir. R. 47.5(a)?

☑ Yes (file separate notice; see below) ☐ No ☐ N/A (amicus/movant)

If yes, concurrently file a separate Notice of Related Case Information that complies with Fed. Cir. R. 47.5(b). **Please do not duplicate information.** This separate Notice must only be filed with the first Certificate of Interest or, subsequently, if information changes during the pendency of the appeal. Fed. Cir. R. 47.5(b).

6. Organizational Victims and Bankruptcy Cases. Provide any information required under Fed. R. App. P. 26.1(b) (organizational victims in criminal cases) and 26.1(c) (bankruptcy case debtors and trustees). Fed. Cir. R. 47.4(a)(6).

☑ None/Not Applicable ☐ Additional pages attached

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STATEMENT OF RELATED CASES

No appeal in or from the same proceeding has previously been before this or any other appellate court.

This Court's decision may directly affect or be directly affected by the following cases that involve the same patent that is at issue in this appeal: *Gesture Tech. Partners, LLC v. Apple, Inc.*, No. 4:22-cv-04806 (N.D. Cal.); *Gesture Tech. Partners, LLC v. LG Elecs., Inc. et al.*, No. 2:21-cv-19234 (D.N.J.); *Gesture Tech. Partners LLC v. Motorola Mobility LLC*, No. 1:22-cv-03535 (N.D. Ill.); and *Gesture Tech. Partners, LLC v. Lenovo Grp. Ltd. et al.*, No. 6:21-cv-00122 (W.D. Tex.).

The Court's decision may also directly affect or be directly affected by the following co-pending appeal, which this Court has designated as a companion case to this appeal, involving a different patent owned by Gesture Technology: *Gesture Tech. Partners, LLC v. Apple Inc. et al.*, No. 23-1463 (Fed. Cir.).

INTRODUCTION

In nearly every respect, the Board in this inter partes review proceeding charted the correct course. It held unpatentable for obviousness 15 of the 18 claims of the patent at issue, including every single independent claim and, indeed, every single limitation but one. Both the law and the evidence amply supported the obviousness of those claims. The Board went astray, however, in holding that Apple had not shown the remaining dependent claims—claims 4, 11, and 18—unpatentable for obviousness. That determination rested on the Board's improper failure to consider the arguments and evidence before it.

At issue are claims related to automatically taking pictures of scenes of interest. The dependent claims on appeal are not distinguished from the ones that the Board held unpatentable by any technological marvel. Quite the opposite: They differ only in their recitation of an insubstantial structural limitation that requires two components—themselves taught by the prior art according to the Board's well-supported findings—to be fixed relative to each other. This fixedness would have been obvious to a skilled artisan. The Board

avoided that conclusion only by incorrectly hamstringing Apple's obviousness presentation in two ways.

First, the Board limited its inquiry to whether Apple had shown inherent disclosure of the limitation at issue. That ignored not only what Apple had argued, but also what the patent owner, Gesture Technology, had argued. Both parties had framed their arguments in terms of conventional obviousness principles, not the inherency doctrine. The Board offered no valid justification for departing from the parties' arguments, nor was there one. And even if the Board could have considered the question of inherency, the Board failed to conduct a proper legal inquiry into it.

Second, the Board failed to consider material evidence that Apple had adduced. Apple presented the Board with expert testimony from both sides that was highly relevant, whether the question at hand was ordinary obviousness or the doctrine of inherency. The Board understood that Apple relied on this evidence, yet the Board inappropriately constrained its assessment to the consideration of one "mere fact"—"[w]ithout more"—about the disclosure of the prior-art reference at issue. Appx34. Had the Board considered that fact in

tandem with the expert testimony that the agency neglected, the outcome of the decision at least could have been different.

These errors, alone or together, warrant reversal or at least vacatur of the Board's decision with respect to dependent claims 4, 11, and 18.

JURISDICTIONAL STATEMENT

The Board had jurisdiction in the inter partes review below under 35 U.S.C. §§ 6(b)(4), 311(a), 316(c), and 318(a). The Board issued its final written decision on December 5, 2022. Apple timely filed a notice of appeal from certain aspects of that decision on February 6, 2023. *See* 35 U.S.C. § 142; 37 C.F.R. § 90.3(a)(1). This Court has jurisdiction under 28 U.S.C. § 1295(a)(4)(A) and 35 U.S.C. §§ 141(c) and 319.

STATEMENT OF THE ISSUES

I. Whether the Board erroneously determined that Apple had not shown claims 4, 11, and 18 unpatentable by miscasting Apple's obviousness challenge in terms of inherency, and whether the Board's inherency analysis, even if relevant, was impermissibly narrow.

II. Whether the Board erroneously determined that Apple had not shown claims 4, 11, and 18 unpatentable by improperly failing to consider material evidence—namely, expert testimony from both sides.

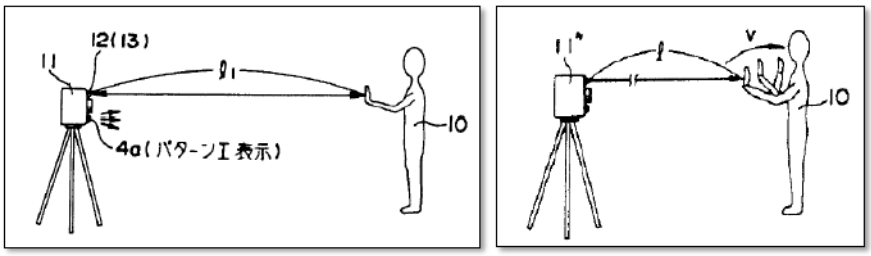
III. Whether, given either or both of the aforementioned issues, the Board's determination that Apple had not shown claims 4, 11, and 18 unpatentable should be reversed or at least vacated.

STATEMENT OF THE CASE

The '949 Patent, Treading Ground Covered By The Prior Art, Claims Using A Sensor And A Camera To Automatically Take A Picture When A Gesture Is Detected.

U.S. Patent No. 8,878,949, owned by Gesture Technology, relates to automatically taking pictures and, specifically, doing so by detecting gestures, such as human poses or movement. Appx41-57. Each independent claim recites a device that includes two components: (1) "an electro-optical sensor" that helps detect whether "a gesture has been performed" and (2) "a digital camera" that captures an image upon the detection of such a gesture. Appx57 15:20-38, 16:1-13, 23-40 (claims 1, 8, and 13); *cf.* Appx52 5:46-49 (picture-triggering gestures could include "raising [a] right hand").

By May 1999, the '949 patent's earliest possible priority date, *see* Appx41,[1] the idea of automating picture taking via gesture detection was far from new. A prior-art patent application, the Nonaka reference, Appx985-1020, described it nearly a decade earlier. Nonaka discusses a camera that allows a user to remotely instruct a picture to be taken by "mak[ing] a predetermined motion." Appx999 15:11-14; *accord* Appx14. Nonaka outlines multiple predetermined gestures that can serve this function, such as holding one's hand out toward the camera (depicted below on the left), Appx987-988 3:34-4:4, or moving one's hand toward the camera (depicted below on the right), Appx990 6:11-22.



Appx1003 (Fig. 3); Appx1005 (Fig. 7).

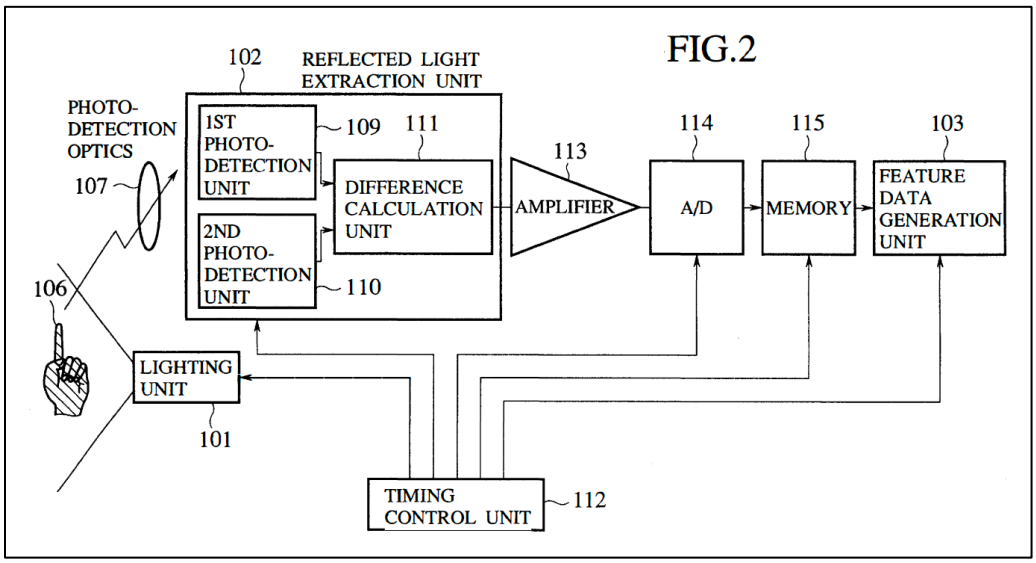
Likewise—and central to Apple's appeal—a prior-art patent called Numazaki, Appx838-984, in a similar context already taught an electro-optical sensor and a digital camera.

[1] To be clear, Apple does not accede to this priority date and reserves the right to challenge it in other proceedings.

Numazaki is directed to, among other things, detecting a person's gestures. Appx838 (Abstract); Appx941 4:9-40; *accord* Appx9-10. It describes fourteen high-level, numerically titled embodiments, contemplating that these overarching embodiments each have sub-embodiments. *See, e.g.*, Appx942-944 5:5-10:5 (referring to different "exemplary configurations" according to the various numerically titled embodiments, such as "one exemplary configuration … according to the fifth embodiment"). Particularly relevant here is Numazaki's fifth embodiment, which builds off the first. *See* Appx944-948 10:21-17:11 (first embodiment); Appx959-960 39:4-41:46 (fifth embodiment).

Numazaki's first embodiment revolves around an information input generation apparatus, incorporating an electro-optical sensor, that detects a user's gestures to issue computer-executed commands. *See* Appx9-11. Figure 2 below illustrates the apparatus. Appx945 11:9-19. Lighting unit 101 emits light that is reflected off target object 106, such as a hand. Appx944 10:29-32; Appx945 11:11-12, 26-33. Reflected light extraction unit 102 is an electro-optical sensor—just like the '949 patent's claimed sensor, Appx18—that detects the amount of light the target receives both when the lighting unit emits light and when it does

not, then uses this information to help identify whether a gesture has been performed. Appx944 10:40-66; Appx945 11:12-56. In this way, gestures can relay commands to a computer. Appx944 10:61-66; *see* Appx953 27:51-56 (describing detection of a finger making a pushing movement to execute a mouse click).



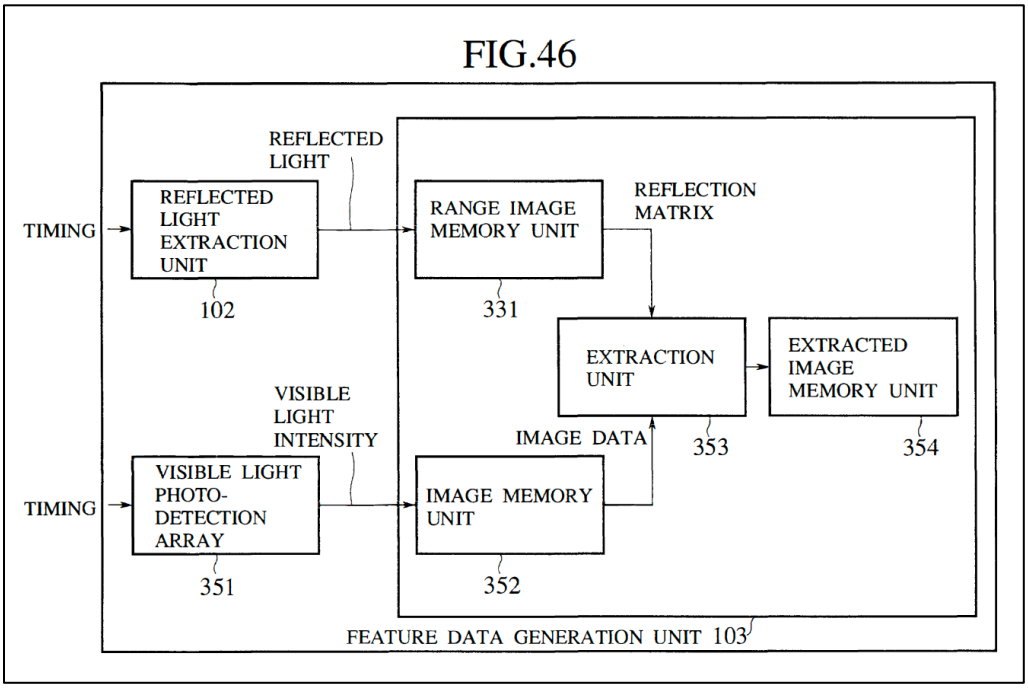
Appx840.

Numazaki's fifth embodiment deals with video capture and transmission for applications such as video conferencing. *See* Appx12-13; Appx959 39:6-20. Specifically, it relates to a technique that extracts and transmits only useful image information—such as "only the faces of both sides" on a video call—to lower communication costs and reduce power consumption. Appx959 39:6-20. To remove extraneous background information from images, Numazaki's fifth embodiment

deploys the electro-optical sensor from the first embodiment, reflected light extraction unit 102, in conjunction with a digital camera, "visible light photo-detection array 351[,] which is generally used as a CCD camera for taking video images." Appx959 39:21-49.

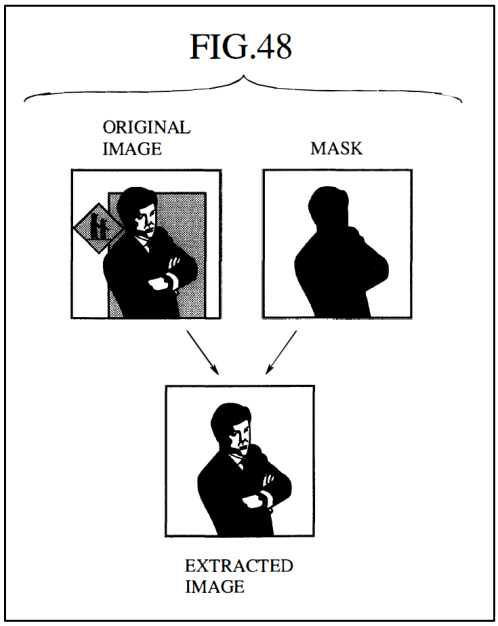
Figure 46 below illustrates "an exemplary configuration of the information input generation apparatus according to this fifth embodiment." Appx959 39:21-23.

FIG.46



Appx883. It is undisputed that, in this configuration, the fifth embodiment discloses reflected light extraction unit 102 and visible light photo-detection array 351 as arranged in parallel and positioned with overlapping fields of view. *See* Appx959 39:21-49.

Using this configuration, the fifth embodiment superimposes the outputs of visible light photo-detection array 351 and reflected light extraction unit 102 to eliminate unwanted information. Appx959 39:24-60. To do so, the output of visible light photo-detection array 351 creates an original image while the output of reflected light extraction unit 102 creates a mask that is stored as a reflection matrix. Appx959 39:51-56. Figure 48 below shows the original image and the mask, depicting a complete overlap as between the outputs:



Appx885. As Figure 48 illustrates, the apparatus extracts the desired image by "super[im]pos[ing] the original image and the mask, and leav[ing] only the overlapping portion." Appx959 39:57-59. The apparatus then stores the extracted image. Appx959 39:59-60.

In short, the fifth embodiment uses an electro-optical sensor (reflected light extraction unit 102) and a digital camera (visible light photo-detection array 351) in a precise configuration to extract as much extraneous information as possible from the components' overlapping outputs—the express goal being to guarantee isolation of "only a specific target" to save power and cut costs. Appx959 39:6-20.

Apple Pursues Inter Partes Review And Generally Demonstrates The Claims To Be Unpatentable For Obviousness.

In February 2021, Gesture Technology sued Apple (and others), alleging infringement of the '949 patent and additional patents. Apple then petitioned for inter partes review, challenging all 18 claims of the '949 patent for obviousness, primarily relying on the combination of Numazaki and Nonaka. Appx117-187 (Apple's petition); Appx738-837 (Apple's petition-stage expert declaration).

Apple's petition showed how each limitation of each claim would have been obvious. With one exception regarding a subset of dependent claims requiring the claimed sensor to be fixed relative to the claimed

camera, detailed below (at 13-20), the Board agreed and therefore instituted review. Appx240-267 (institution decision).[2]

For example, Apple showed that Numazaki's reflected light extraction unit 102 discloses the claimed sensor because, consistent with the ordinary meaning of "electro-optical sensor," Numazaki's unit senses light and converts it into electronic signals. Appx146-147 (citing Appx945 12:56-57; Appx947 15:23-27, 50-52); *accord* Appx18. And as Apple explained, Appx146-147; Appx161, Numazaki discloses that the unit can include "'CMOS sensors' or 'CCD image sensors,'" Appx760 ¶ 35 (quoting Appx947 15:24-16:19), satisfying dependent claim 7's additional requirement that the sensor "includes at least one of a CCD detector and a CMOS detector," Appx57 15:50-52.

Likewise, Apple showed that Numazaki's visible light photo-detection array 351 discloses the claimed camera because Numazaki states that the array can be a digital camera—namely, "a 'CCD camera for taking video images.'" Appx147 (quoting Appx959 39:34).

[2] After institution, LG and Google—appellees here—also filed petitions, and the Board joined their proceedings with Apple's. Appx1 n.1; Appx2.

Apple further showed that a skilled artisan would have combined these components from Numazaki's fifth embodiment into a portable laptop disclosed in Numazaki's eighth embodiment, Appx138-144, Appx771-777 ¶¶ 48-51, Appx964 50:25-39; *see* Appx13-14, satisfying limitations requiring a "device housing" or "portable device" incorporating the components, *see, e.g.*, Appx57 15:22-26 (claim 1 reciting such a device housing); Appx57 16:2-5 (claim 8 reciting such a portable device). As Apple explained, a skilled artisan would have made the combination to gain the benefit of "the fifth embodiment's videoconference functionality in the eighth embodiment's laptop device." Appx144.

Apple also showed that a skilled artisan would have made a similar combination to meet limitations regarding "a processing unit" used to identify whether "a gesture has been performed." *See, e.g.*, Appx57 15:26-31 (claim 1). In particular, Apple demonstrated that a skilled artisan would have modified the laptop of Numazaki's eighth embodiment, which includes a processing unit, Appx780 ¶ 54, to use gesture recognition as disclosed in Numazaki's third embodiment, Appx954 29:22-30:5; *see* Appx11-12, to initiate the videoconferencing

functionality of Numazaki's fifth embodiment. Appx149 (incorporating Appx138-143). As Apple explained, a skilled artisan would have been motivated to make this combination to improve the user experience, "by allowing users to position themselves in place before the video camera and initiate video capture through a gesture, rather than a physical input or timer mechanism." Appx149.

A Key Dispute Arises On The Obviousness Of Dependent Claims 4, 11, And 18, Which Are Distinguished Merely By Requiring The Sensor And The Camera To Be Fixed Relative To Each Other.

With respect to the present appeal, the key dispute below was the obviousness of dependent claims 4, 11, and 18. These claims differ from the independent claims in a single, trivial respect. Namely, they add a simple structural limitation: that the claimed sensor and camera are "fixed" relative to each other. Appx57 (15:43-44, 16:18-20, 49-50). The claims articulate the fixed limitation in slightly different ways, but the differences are irrelevant to the dispute at hand.[3]

[3] Claim 4's fixed limitation: "[T]he electro-optical sensor is fixed in relation to the digital camera." Appx57 (15:43-44).

Claim 11's fixed limitation: "[T]he electro-optical sensor includes first and second sensors in fixed relation relative to the digital camera." Appx57 (16:18-20).

One limitation related to the fixed limitation is relevant here. Claim 1, from which claim 4 depends, recites "a device housing including a forward facing portion, the forward facing portion of the device housing encompassing an electro-optical sensor having a field of view and including a digital camera separate from the electro-optical sensor." Appx57 15:20-25. Apple's petition showed that Numazaki taught this limitation through the combination of its eighth and fifth embodiments. Appx144-147; Appx777-779 ¶ 52. As explained above (at 11-12), Apple showed that Numazaki's laptop taught the device housing, Numazaki's reflected light extraction unit 102 taught the claimed sensor, and Numazaki's photo-detection array 351 taught the claimed camera.

Particularly salient here, Apple's petition also showed that a skilled artisan would have understood these components to be forward facing and to have overlapping fields of view. Appx145-146; Appx778-779 ¶ 52. As Apple and its expert explained, if the components did not face forward toward the user and overlap in their fields of view, "the

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Claim 18's fixed limitation: "[T]he sensor is fixed in relation to the digital camera." Appx57 (16:49-50).

output of the [sensor] could not be used to define which portions of the [camera]'s output should be retained," which would interfere with the fifth embodiment's purpose of "extract[ing] all background image data falling outside the [sensor-generated] mask to arrive at a streamlined image that contains only the subject—the 'extracted image.'" Appx779-780 ¶ 52. Put otherwise, the two components must be forward facing and have overlapping fields of view "to define what is extracted from the other." Appx145-146.

Apple's petition built upon this showing to demonstrate the obviousness of the fixed limitation. Specifically, Apple showed the fixed limitation's obviousness by pointing to two disclosures in Numazaki: (1) the precise configuration of the sensor and the camera in the fifth embodiment and (2) how that configuration serves the embodiment's purpose of removing extraneous background information from an image. Appx156 (incorporating Appx144-146); Appx162-165; Appx167; *see infra* 32-34 & n.4. As to the former, Apple invoked the fact that the fifth embodiment's sensor and camera are positioned both "side-by-side such that they have overlapping fields of view" and "in parallel." Appx156 (internal quotation marks omitted). As to the latter, Apple

invoked the fact that this configuration—particularly the overlapping fields of view vis-à-vis the sensor and the camera—is required to extract extraneous background information from an image per the fifth embodiment's purpose. Appx156 (incorporating Appx144-146); *see supra* 7-10. In sum, Apple showed that a skilled artisan reading Numazaki would have understood the fifth embodiment's sensor and camera to be fixed relative to one another, or at least would have known to implement such fixedness, to ensure overlapping fields of view and, consequently, the removal of extraneous background information that Numazaki expressly intended.

The Board's institution decision agreed that Apple had shown a reasonable likelihood of prevailing on all limitations outside the fixed limitation and thus all claims outside of dependent claims 4, 11, and 18. *See* Appx261-263. Given the fixed limitation, however, the Board "question[ed] whether" Apple had "establish[ed] sufficiently that claims 4, 11, and 18 would have been obvious." Appx262. Without mentioning the overlapping fields of view as between the fifth embodiment's sensor and camera or how that overlap relates to the embodiment's purpose, the Board opined: "Petitioner appears to be arguing that Numazaki's

electro-optical sensor (reflected light extraction unit 102) and digital camera (visible light photo-detection array 351) must be fixed relative to each other because they are arranged in parallel. We are not persuaded, however, that being arranged in parallel necessarily means that reflected light extraction unit 102 and visible light photo-detection array 351 are fixed relative to each other." Appx262.

Gesture Technology's patent owner response followed suit, objecting that "[a] POSITA would not interpret" the parallel arrangement "to necessarily mean" that the fifth embodiment's sensor and camera "are fixed relative to each other." Appx308; *accord* Appx2002 ¶ 71 (Gesture Technology's expert testifying that the parallel arrangement would not have "convey[ed]" the requisite fixedness to a skilled artisan). Like the Board, Gesture Technology did not address the sensor's and camera's overlapping fields of view.

Apple's reply, submitted with a supplemental expert declaration, rebutted the focus on how a skilled artisan would have understood Numazaki's disclosure of a parallel arrangement by arguing the obviousness of the fixed limitation based on the overlapping-fields-of-view aspect of the configuration that the petition had also raised. *See*

Appx356-357 (reply); Appx1782-1784 ¶¶ 13-15 (supplemental declaration). As Apple and its expert explained, "a POSITA would have considered" fixing Numazaki's sensor and camera based on their overlapping fields of view because—as Gesture Technology's own expert admitted at deposition—they "must retain [their] overlapping fields of view in order to 'satisfy the intended purpose' of Numazaki's fifth embodiment." Appx357 (quoting Appx1809); Appx1783-1784 ¶¶ 14-15.

Gesture Technology then submitted a sur-reply further disputing the obviousness of the fixed limitation. Appx375-377. Gesture Technology contended that "Numazaki never discloses" that its sensor and camera "have or require identical fields of view" and that its expert "testified that only a 'partial overlap' in the fields of view is needed to accomplish of the goal of Numazaki's fifth embodiment." Appx376 (quoting Appx1809; emphases omitted). Gesture Technology also contended that "movement of these two components … relative to each other does not necessarily result in non-overlapping fields of view." Appx376. Gesture Technology continued: "Accordingly, Petitioner's alleged 'overlapping fields of view' requirement is not a barrier to movement of these two components … relative to each other. Thus,

Petitioner has failed to show how Numazaki teaches or suggests [the fixed limitation]." Appx376-377.

At the oral hearing, a panel member (ultimately the author of the final written decision here), asked Apple's counsel whether he "would … characterize" Apple's argument on the fixed limitation as "an inherency argument." Appx438 (Scanlon, J.). Apple's counsel answered in the negative, explaining that Apple had made a conventional "103 argument" regarding how a skilled artisan "would understand [Numazaki's] teachings." Appx438.

Notably, the word "inherency" had not appeared in the proceedings before this stage. Gesture Technology had not suggested that Apple had argued inherency or moved to exclude Apple from arguing the obviousness of the fixed limitation under an ordinary analysis. After the panel member asked Apple's counsel about inherency, however, Gesture Technology's counsel encouraged an inherency framing at the hearing. *See* Appx440 ("I think the Board was correct to ask, is this an inherency argument? And the answer is yes.").

Another panel member sitting at the hearing reacted by explaining his view that inherency was not the issue: "So I think this

inherency is a little bit of a red herring. I think Petitioner made it pretty clear that what they're doing with … the [claimed] fixed relationship … is [arguing that it is] something that would have been obvious to a person of ordinary skill in the art." Appx446 (Anderson, J.); *accord* Appx447. After the hearing, however, that panel member was rotated out "[d]ue to unavailability," Appx2425, such that he was not a member of the panel that rendered the Board's final written decision, Appx1.

The Board Holds All Claims Unpatentable For Obviousness—Except Dependent Claims 4, 11, And 18.

The Board's final written decision held that claims 1-3, 5-10, and 12-17 were unpatentable for obviousness in light of Numazaki and Nonaka. *See* Appx15-32.

Notwithstanding that Apple had shown that every limitation other than the fixed limitation fell to obviousness, the Board rejected Apple's obviousness challenge as to dependent claims 4, 11, and 18, which stand apart from the other claims *only* in reciting the fixed limitation. *See* Appx32-35. The problem, in the Board's view, was that Apple had not "establish[ed] sufficiently" that Numazaki's sensor and

camera "are fixed" relative to one another. Appx34. The Board reached that conclusion by making two analytical moves.

First, the Board dispensed with the question of the fixed limitation's conventional obviousness, suggesting that Apple had instead made "an inherency argument." Appx34. The Board acknowledged that, "[a]t the oral hearing, counsel for Petitioner indicated that Petitioner's position was not an inherency argument" but rather a straightforward obviousness argument. Appx34. The Board observed, however, that "[t]he Petition … d[id] not reference" any testimony by Apple's expert on the obviousness of the fixed limitation specifically. Appx34. The Board did not address the fact that other evidence on this obviousness question existed—including Apple's supplemental expert declaration on reply—or the fact that Gesture Technology itself had argued about the obviousness of the fixed limitation in conventional terms. Instead, the Board proceeded on the merits as though Apple had argued only that Numazaki inherently disclosed the fixed limitation, concluding that Apple had not shown the Numazaki's sensor and camera "are fixed" as claimed. *See* Appx34-35.

Second, the Board reached its conclusion as to fixed limitation by considering only "the mere fact"—"[w]ithout more"—"that Numazaki's" sensor and camera "are arranged in parallel and have overlapping fields of view." Appx34. Both Apple's and Gesture Technology's expert had testified about how this configuration related to the fifth embodiment's purpose and whether that relationship would have suggested fixing the configuration. And Apple had presented this testimony to the Board. But the Board did not analyze it. *See* Appx34-35.

Apple filed this appeal challenging the Board's decision as to dependent claims 4, 11, and 18. Gesture Technology then filed a cross-appeal challenging the Board's conclusion that the other 15 claims of the '949 patent are unpatentable for obviousness.

SUMMARY OF ARGUMENT

The Board rejected Apple's obviousness challenge to claims 4, 11, and 18 on a single, flawed basis: that Apple had not "establish[ed] sufficiently" that the sensor and digital camera of Numazaki's fifth embodiment "are fixed relative to one another." Appx34. Under a proper analysis, Apple established that Numazaki taught or suggested the fixed limitation. But the Board did not conduct a proper analysis.

Instead, the Board's assessment hinged on two overarching and highly prejudicial errors. Given either or both of these errors, the Board's decision cannot stand.

I. The Board's first error was to incorrectly frame what Apple needed to "establish sufficiently." Appx34. Apple made a conventional obviousness argument—namely, that the fixed limitation would have been obvious to a skilled artisan reading Numazaki. Apple's petition, fairly construed, raised obviousness in this ordinary sense. And if there were any doubt, Gesture Technology itself put run-of-the-mill obviousness at issue by opposing Apple's obviousness challenge to the fixed limitation based on what Numazaki would have suggested to a skilled artisan. Nevertheless, the Board mistakenly cast the question of obviousness only in terms of whether Numazaki inherently disclosed the fixed limitation, ostensibly because Apple made "an inherency argument" despite disavowing one. Appx34. The Board's singular focus on inherency impermissibly ignored the normal question of obviousness that the parties had raised. And in doing so, the Board improperly imposed a higher bar of proving obviousness than Apple needed to clear.

Moreover, the Board compounded the problem by failing to analyze inherency under the governing legal standard. Even to the extent that Apple's obviousness challenge implicated the inherency doctrine, the Board's evaluation of inherency was incomplete. Inherency can be shown in two ways: (1) by showing that a limitation is necessarily present in the prior art or (2) by showing that the limitation is the natural result of the disclosures in the prior art. But the Board asked only whether the fixed limitation is necessarily present in Numazaki, ignoring the question of whether the fixed limitation is the natural result of Numazaki's disclosures. That partial analysis was incorrect and prejudicial.

II. The Board's second error was its failure to consider material evidence. The Board analyzed the question of obviousness based on a single fact: that the sensor and camera of Numazaki's fifth embodiment "are arranged in parallel and have overlapping fields of view." Appx34. The Board concluded that this "mere fact"—"[w]ithout more"—"does not establish that the structures are [relevantly] fixed." Appx34. That conclusion was beside the point, however, because it improperly ignored that Apple had adduced "more" that needed to be factored into the

analysis. In particular, the Board disregarded testimony from both parties' experts that fixing Numazaki's sensor and camera in relation to each other furthered the purpose of these components as disclosed by Numazaki in the context of its fifth embodiment. Whether the issue to be decided was ordinary obviousness or inherent disclosure, the expert testimony that the Board failed to consider was highly relevant, and nothing in the Board's decision justified skewing the record by giving this evidence no weight.

III. The Board's errors independently mandate reversal or vacatur of the agency's determination that Apple did not show claims 4, 11, and 18 unpatentable. At a minimum, vacatur is required because each error had a material bearing on the outcome reached by the Board. That said, reversal is warranted based on the Board's improper inherency-only assessment of obviousness. Viewed through the lens of conventional obviousness principles, the record permits only one conclusion: that a skilled artisan reading Numazaki would be led to the fixed limitation. This Court should so hold.

STANDARD OF REVIEW

Generally. This Court "review[s] decisions by the Board under the standards set forth in the Administrative Procedure Act (APA), 5 U.S.C. § 706." *Vicor Corp. v. SynQor, Inc.*, 869 F.3d 1309, 1319 (Fed. Cir. 2017). Under the APA, this Court must set aside Board determinations that are "arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law"; "without observance of procedure required by law"; or "unsupported by substantial evidence." 5 U.S.C. § 706(2); *accord Rovalma, S.A. v. Bohler-Edelstahl GmbH & Co. KG*, 856 F.3d 1019, 1024 (Fed. Cir. 2017).

Questions of law. "The Board's legal determinations are reviewed *de novo*." *Vicor*, 869 F.3d at 1320. Legal questions include the ultimate issue of obviousness, *id.*, whether the Board "compli[ed] with the governing legal standards," *Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1073 (Fed. Cir. 2015); *accord Princeton Vanguard, LLC v. Frito-Lay North America, Inc.*, 786 F.3d 960, 964 (Fed. Cir. 2015), and whether the Board provided a party with adequate notice and opportunity to respond to a matter decided by the agency, *In re IPR*

Licensing, Inc., 942 F.3d 1363, 1368-69 (Fed. Cir. 2019) (citing *In re NuVasive, Inc.*, 841 F.3d 966, 970 (Fed. Cir. 2016)).

Questions of fact. The Board's "factual findings"—such as those underlying the obviousness inquiry—are reviewed for "substantial evidence." *Vicor*, 869 F.3d at 1320. Substantial evidence is that which "a reasonable mind might accept … to support the factual conclusion" challenged. *In re Kotzab*, 217 F.3d 1365, 1369 (Fed. Cir. 2000). It is "something less than the weight of the evidence but more than a mere scintilla of evidence." *Id.* "In reviewing … for substantial evidence," this Court "must take into account evidence that both justifies and detracts from the factual determination" at issue. *Id.*; *accord PPC Broadband, Inc. v. Iancu,* 739 F. App'x 615, 619, 624 (Fed. Cir. 2018).

Questions of Board procedure. "Decisions related to compliance with the Board's procedures"—such as whether a party exceeded the scope of a proper reply—"are reviewed for an abuse of discretion." *Ericsson Inc. v. Intell. Ventures I LLC*, 901 F.3d 1374, 1379 (Fed. Cir. 2018); *accord Apple Inc. v. Andrea Elecs. Corp.*, 949 F.3d 697, 705 (Fed. Cir. 2020). A decision amounts to an abuse of discretion if it is "(1) is clearly unreasonable, arbitrary, or fanciful; (2) is based on an

erroneous conclusion of law; (3) rests on clearly erroneous fact finding; or (4) involves a record that contains no evidence on which the Board could rationally base its decision." *Ericsson*, 901 F.3d at 1379 (internal quotation marks omitted).

ARGUMENT

I. The Board Erroneously Determined That Apple Had Not Shown Claims 4, 11, And 18 Unpatentable By Miscasting Apple's Obviousness Challenge In Terms Of Inherency.

The Board limited its analysis of the fixed limitation to the question of whether Numazaki inherently disclosed the limitation. *See* Appx32-35. The Board's inherency-only treatment was flawed in two independent respects. First, the Board ignored Apple's actual argument (which Gesture Technology's opposition mirrored): that the fixed limitation would have been obvious to a skilled artisan reading Numazaki. § I.A. Second, the Board's assessment of inherency was materially incomplete because the Board asked only whether the fixed limitation was necessarily present in Numazaki, without consideration of an essential alternative basis for inherency under governing law: whether the limitation would be the natural result of a skilled artisan constructing a device in accordance with Numazaki's disclosures. § I.B.

A. The Board wrongly conflated Apple's run-of-the-mill obviousness argument with an inherency argument.

The Board determined that Apple had "not establish[ed] sufficiently" the obviousness of the fixed limitation in light of Numazaki based on a misunderstanding of Apple's mode of argument. Appx34. In the Board's view, Apple made an inherency argument. *See* Appx34. As a result, the Board analyzed only whether Apple had cleared the high hurdle of showing inherent disclosure, then the Board stopped. *See* Appx32-35. But Apple never argued inherency. Apple instead argued that Numazaki taught or suggested the fixed limitation under ordinary obviousness principles. Specifically, Apple argued that a skilled artisan would have *understood* Numazaki to encompass and favor a fixed configuration between the fifth embodiment's sensor and camera, regardless of whether fixedness *necessarily* obtains in every conceivable instance of Numazaki's device. Gesture Technology's opposition sounded in the same terms. The Board's single-minded focus on inherency therefore violated the APA by "fundamentally misconstru[ing]"—and thus "fail[ing] to adequately evaluate"—the obviousness issue before it. *Power Integrations, Inc. v. Lee*, 797 F.3d

1318, 1323-25 (Fed. Cir. 2015); *accord Provisur Techs., Inc. v. Weber, Inc.*, 50 F.4th 117, 123-24 (Fed. Cir. 2022).

1. The Board restricted its obviousness inquiry to whether Apple had shown inherent disclosure. The Board indicated that Apple argued "inherency." Appx34. In accord, the Board apparently faulted Apple for failing to prove that Numazaki's sensor and camera are "*necessarily* … fixed relative to each other." Appx34 (emphasis added). Necessity is a touchstone of inherency: "The inherency doctrine allows for a prior art reference to supply a missing limitation if it is 'necessarily present' or 'inherent' in that reference." *Vivint, Inc. v. Alarm.com Inc.*, 741 F. App'x 786, 791 (Fed. Cir. 2018) (quoting *Schering Corp. v. Geneva Pharms., Inc.*, 339 F.3d 1373, 1377 (Fed. Cir. 2003)).

2. The Board's singular focus on inherency raised the burden of showing obviousness. Reliance on the inherency doctrine—and its necessity prong specifically—makes an obviousness challenge more difficult to prove than a normal obviousness attack. *See Toyota Motor Corp. v. Reactive Surfaces Ltd.*, 816 F. App'x 480, 484 (Fed. Cir. 2020) (showing inherency in the obviousness context requires meeting "an exacting standard"); *PAR Pharm., Inc. v. TWI Pharms., Inc.*, 773 F.3d

1186, 1195-96 (Fed. Cir. 2014) ("A party must … meet a high standard in order to rely on inherency to establish the existence of a claim limitation in the prior art in an obviousness analysis.").

3. Contrary to the Board's stringent inherency-only analysis, Apple did not argue that Numazaki inherently disclosed the fixed limitation but rather that a skilled artisan reading Numazaki would have understood the fifth embodiment to call for the fixedness required. Inherent disclosure and what a skilled artisan would have taken away from a reference are two different things. The former generally stands separate and apart from a skilled artisan's understanding; the latter must be based upon it. *See Vivint*, 741 F. App'x at 791 ("what would have been obvious to a skilled artisan is not a valid consideration in an inherency analysis"; "'[i]nherency and obviousness are distinct concepts'" (quoting *W.L. Gore & Assocs., Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1555 (Fed. Cir. 1983))); *In re Shetty*, 566 F.2d 81, 86 (C.C.P.A. 1977) ("'[I]nherency … and … obviousness are entirely different questions. That which may be inherent is not necessarily known. Obviousness cannot be predicated on what is unknown.'" (quoting *In re Spormann*, 363 F.2d 444, 448 (C.C.P.A. 1966))); *cf. Rexnord Indus., LLC*

v. Kappos, 705 F.3d 1347, 1354-56 (Fed. Cir. 2013) (affirming the Board's finding of no inherent anticipation of a structural limitation but reversing the Board's determination of nonobviousness because a skilled artisan would have gleaned the limitation from the disclosures in the prior-art references at issue).

Apple's petition, in its sections detailing the obviousness of the fixed limitation, set forth the disclosures in Numazaki that would have led a skilled artisan to fixedness between the sensor and camera of the fifth embodiment. To start, Apple's petition explained that Numazaki precisely configures the components in relation to each other in two ways: (1) they are "position[ed] … side-by-side such that they have overlapping fields of view" and (2) they are "arranged in parallel." Appx156. Further, Apple's petition indicated that this precise configuration between the sensor and camera taught or suggested their fixedness relative to each other because the configuration is key to the purpose of Numazaki's fifth embodiment. Specifically, the embodiment uses the sensor's output to define which portions of the camera's output should be deleted versus retained, such that overlap between the components' outputs—a function of their location relative to each

other—is essential to "remov[e] extraneous … information that would otherwise consume bandwidth and battery power" as Numazaki intends. Appx144-146; *cf.* Appx156 (section on the fixed limitation including this discussion by reference); *see supra* 7-10. The upshot: A skilled artisan would have understood Numazaki to teach or suggest fixedness between the fifth embodiment's sensor and camera to ensure their configuration relative to each other and, consequently, their whole point. *Cf. Intel Corp. v. Alacritech, Inc.*, 817 F. App'x 1014, 1017 (Fed. Cir. 2020) ("'A reference must be considered for everything it teaches by way of technology and is not limited to the particular invention it is describing and attempting to protect.'" (quoting *EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985))); *Bradium Techs. LLC v. Iancu*, 923 F.3d 1032, 1049 (Fed. Cir. 2019) ("[A] reference must be considered not only for what it expressly teaches, but also for what it fairly suggests." (internal quotation marks omitted)). Apple's petition thus raised a classic form of obviousness argument: The obviousness of

a limitation based upon what a skilled artisan would have recognized from reading a prior-art reference.[4]

The ensuing submissions of the parties then confirmed that Apple raised this typical form of obviousness argument.

Apple's reply brief and supplemental expert declaration, responding to how Gesture Technology itself posed the issue, hammered home the inference of fixedness that would have been made by a skilled artisan reading Numazaki. Gesture Technology's patent owner response argued that "[a] POSITA *would not interpret*" Numazaki "to necessarily mean" that its sensor and camera "are fixed relative to each

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[4] *See, e.g.*, *C.R. Bard, Inc. v. Medline Indus., Inc.*, No. 20-1900, 2021 WL 3574043, at *4-5 (Fed. Cir. Aug. 13, 2022) (explaining that, even when a prior-art reference does not "'expressly' direct a skilled artisan" to a particular limitation, "[w]hen two equally viable options are available … , then, without more, either one would seem to have been obvious," particularly an option that "a skilled artisan had ample reason to avail himself of"; holding that the Board erred by disregarding this "'expansive and flexible'" approach to obviousness (quoting *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 415 (2007))); *In re Black*, 778 F. App'x 911, 917-18 (Fed. Cir. 2019) (upholding the obviousness of a limitation based on a single reference: "[I]t is reasonable to read Arling and conclude that the commands and device definitions may exist in a single tag file in light of the knowledge of a person of ordinary skill. A person of ordinary skill in the art attempting to solve a problem is not wholly restricted to the literal confines of the prior art. … Therefore, drawing upon the creativity of a person of ordinary skill, it is not unreasonable to conclude that Arling implicates [the requisite] tag file.").

other." Appx308 (emphasis added). Likewise, Gesture Technology's expert argued that the fixed limitation *would "not [have been] convey[ed]* to a POSITA" by Numazaki. Appx2002 ¶ 71 (emphasis added). So, as Gesture Technology confirmed in its sur-reply, Gesture Technology's opposition was based on what Numazaki would have "t[aught] or suggest[ed]" to a skilled artisan. Appx377. Rebutting Gesture Technology's argument as to what a skilled artisan would have understood, Apple's reply brief and supplemental expert declaration explained that, because "satisfy[ing] the intended purpose of Numazaki's fifth embodiment" requires fixing its precise configuration of its sensor and camera, "a *POSITA would have considered*" that these structures are or at least should be "fixed in relation to each other." Appx357 (emphasis added; internal quotation marks omitted); Appx1784 ¶ 15 (same); *see* Appx1783-1784 ¶ 14 (similarly framing the need for lack of movement between Numazaki's sensor and camera in terms of what "a *PHOSITA would have understood*" (emphasis added)).

Apple then verified at the oral hearing that it argued what a skilled artisan would have taken away from Numazaki. A panel member pointedly asked Apple's counsel whether he "would …

characterize" Apple's argument as "an inherency argument." Appx438 (Scanlon, J.). His response: "I would not." Appx438. Rather, Apple made "a 103 argument where [Apple's expert] is interpreting how one of skill in the art *would understand* [Numazaki's] teachings. … So we have not jumped through the hoops of inherency." Appx438 (emphasis added). The Board's final written decision even acknowledged that Apple's counsel had "indicated" that Apple's theory "was not an inherency argument" but instead an ordinary obviousness argument. Appx34. Nevertheless, the Board did not consider Numazaki's teachings through the lens of conventional obviousness principles. *See* Appx32-35. Rather, the Board decided the fixed limitation only on the brand-new inherency framing that the agency itself injected into the proceedings at the oral hearing, *see supra* 19, which was too late in the case for Apple to "meaningfully respond," *Dell Inc. v. Acceleron, LLC*, 818 F.3d 1293, 1301 (Fed. Cir. 2016).

4. The Board's failure to engage with the obviousness issue that Apple—and Gesture Technology—raised violated the agency's duty "to provide a full and reasoned explanation of its decision." *Power Integrations*, 797 F.3d at 1323-24. The Board supplies "an inadequate

predicate" for its judgment when it fails to sufficiently evaluate a party's "primary argument"—and particularly when, as here, it "focuse[s] on" an argument that the party has "expressly disavowed." *Id.* at 1325. What a skilled artisan would have understood based on Numazaki was "the critical issue" and the focus of both Apple's and Gesture Technology's arguments; inherent disclosure, by contrast, was a "red herring." *Id.*; *accord* Appx446. Thus, the Board's exclusive consideration of the latter was erroneous. *Power Integrations*, 797 F.3d at 1325; *accord Provisur*, 50 F.4th at 123-24 (holding that the Board "violate[d] the APA" when it "limited its analysis" to a "mischaracterization" of a party's argument); *Netflix, Inc. v. DivX, LLC*, No. 22-1083, 2023 WL 2298768, at *4 (Fed. Cir. Mar. 1, 2023) (holding that the Board committed "a fundamental legal error" when it "pervasively substitut[ed] a focus on" a "redefinition" of the petitioner's argument).

5. Although the Board did not clearly do so, it may have attempted to justify its inherency-only treatment on the notion that Apple's petition did "not reference" an obviousness analysis sounding outside of inherency. Appx34-35. The facial lack of clarity in the

Board's statements on this score is compounded by the fact that, at the oral hearing, a member of then-constituted panel expressed that he understood Apple to be arguing regular obviousness and that inherency was "a little bit of a red herring." Appx446 ("I think Petitioner made it pretty clear that what they're doing with … the [claimed] fixed relationship … is [arguing that it is] something that would have been obvious to a person of ordinary skill in the art.") (Anderson, J.). The Board's final written decision does not address that understanding; rather, the Board objected only that the petition lacked *testimony from Apple's expert* "analy[zing] and interpret[ing]" whether the fixed limitation was *"require[d]"* by Numazaki. Appx34-35 (emphasis added). The Board's objection missed the mark because a limitation's obviousness need not turn on expert testimony or whether the limitation was required or explicitly disclosed by a prior-art reference; instead, recourse to common sense and whether a skilled artisan would have "appreciate[d] the potential value" of a limitation can be sufficient, and such a showing can be made even with "[n]o expert opinion." *Perfect Web Techs., Inc. v. InfoUSA, Inc.*, 587 F.3d 1324, 1330 (Fed. Cir.

2009); *accord* Appx446 ("*KSR* also says … that we can apply common sense.") (Anderson, J.).

To the extent that the Board meant to convey that an ordinary obviousness argument regarding the fixed limitation fell outside the scope of the proceedings, such a decision was an abuse of discretion for three independent reasons.

First, as explained above (at 32-34 & n.4), Apple's petition, in sections addressing the obviousness of the fixed limitation, raised a challenge based on what a skilled artisan would have understood from Numazaki. Specifically, Apple's petition pointed to the following disclosures in Numazaki that would have taught or suggested the fixed limitation to a skilled artisan: (1) the precise configuration of the fifth embodiment's sensor vis-à-vis its camera (most critically, that they are positioned to have overlapping fields of view) and (2) a clear reason to make that configuration fixed (namely, that doing so advances the fifth embodiment's purpose). *See supra* 32-33. And notably, none of the petition's discussion invoked inherency. *See* Appx156 (incorporating by reference Appx144-146). "All of this, fairly read, convey[ed] that" Apple's petition argued obviousness in conventional terms, based on

how a skilled artisan would have understood Numazaki, as Apple's post-petition elaborations "permissibly clarif[ied]" by being "more explicit." *Uniloc 2017 LLC v. Facebook, Inc.*, No. 2019-2162, 2021 WL 5370480, at *8 (Fed. Cir. Nov. 18, 2021). Any contrary determination by the Board "pars[ed] [Apple]'s arguments … with too fine a filter." *Ericsson*, 901 F.3d at 1380.

Second, Gesture Technology engaged Apple's argument in the same terms—as a conventional obviousness argument—and Apple was entitled to respond in kind. Regardless of the exact nature of the obviousness theory in the petition, Apple's post-petition contentions regarding what a skilled artisan would have understood from Numazaki responded to an argument that was raised, if nowhere else, in Gesture Technology's patent owner response. As discussed above (at 34-35), Gesture Technology opposed the obviousness of the fixed limitation based on what Numazaki would have "suggest[ed]," Appx377 (Gesture Technology's sur-reply), and "convey[ed]" to a skilled artisan, Appx2002 ¶ 71 (Gesture Technology's expert declaration submitted with its patent owner response); *accord* Appx308 (Gesture Technology's patent owner response arguing based on how a skilled artisan would

have "interpret[ed]" Numazaki). Under both this Court's caselaw and the Board's regulations, Apple had the right to rebut Gesture Technology's position with a "responsive … argument[]" about what a skilled artisan would have grasped from the reference. *Apple*, 949 F.3d at 706; *accord Everstar Merch. Co. v. Willis Elec. Co.*, No. 21-1882, 2022 WL 1089909, at *4 (Fed. Cir. Apr. 12, 2022) ("[A] petitioner is entitled in its reply to 'respond to arguments raised in the corresponding opposition, patent owner preliminary response, patent owner response, or decision on institution.'" (quoting 37 C.F.R. § 42.23(b))).

Third, the Board pinned its passing statement that Apple's petition did "not reference" a normal obviousness theory on a legally erroneous premise: that Apple had a petition-stage obligation to present expert testimony supporting such an analysis. Appx34 (objecting that "[t]he Petition … does not reference" an "analysis and interpretation of Numazaki[]" by Apple's expert specific to the fixed limitation). "No rule requires a Petition to be accompanied by any declaration, let alone one from an expert guiding the Board as to how it should read prior art." *Belden*, 805 F.3d at 1079. Indeed, in this case—given both that the reference and the claim limitation at issue "'are easily understandable'"

and that the Board has relevant "expertise"—expert testimony was not even "necessary for the prima facie case of obviousness" *at all*. *Id.* (quoting *Wyers v. Master Lock Co.*, 616 F.3d 1231, 1242 (Fed. Cir. 2010)); *accord Perfect Web*, 587 F.3d at 1330. A fortiori, the Board could not ignore Apple's obviousness argument merely because Apple provided expert testimony specific to that argument *at the reply stage*, rather than at the outset.[5]

B. Even to the extent that inherency was a relevant consideration, the Board improperly skipped over the doctrine's natural-result prong.

Separately, even if Apple's obviousness challenge implicated the inherency doctrine (which Apple disputes), the Board erred in evaluating that issue by failing to consider a way to satisfy the doctrine besides showing that the fixed limitation is a necessary feature of every

[5] To be clear, Apple submitted an expert declaration alongside its petition, Appx738-837, and Apple's petition cited that declaration in connection with the fixed limitation to prove its obviousness, Appx144-147 (petition section incorporated by reference in Appx156 citing relevant expert testimony, such as Appx777-780 ¶ 52); *cf.* Appx356-357 (Apple's reply elaborating on this citation); Appx1783-1784 ¶¶ 14-15 (Apple's supplemental expert declaration similarly elaborating). But whereas Apple's petition, reply, and supplemental expert declaration contained sections specifically addressing the fixed limitation, Apple's original expert declaration did not. *E.g.*, Appx156 (petition); Appx356-357 (reply); Appx1782-1784 ¶¶ 13-15 (supplemental declaration).

possible iteration of Numazaki's fifth embodiment. Inherency requires showing one of two disjuncts: that "the limitation at issue necessarily must be present, *or* the natural result of the combination of elements explicitly disclosed by the prior art." *PAR Pharm.*, 773 F.3d at 1196 (emphasis added); *accord Hill-Rom Servs., Inc. v. Matal*, 716 F. App'x 996, 1004 n.3 (Fed. Cir. 2017) (setting forth the two prongs as an "either … or" proposition). Here, the Board considered the first way of proving inherency: whether the fixed limitation is necessarily present in Numazaki. But that is all the Board considered. The Board failed to analyze—or even mention—the second avenue of establishing inherency: whether the fixed limitation is the natural result of Numazaki's disclosures. *See* Appx32-35.

Meanwhile, the record evinces that Numazaki's disclosures naturally result in the fixed limitation. As explained above (at 18, 32-33, 35), fixedness between the sensor and camera of Numazaki's fifth embodiment ensures that these components have overlapping fields of view and thus that the embodiment thus can fulfill its purpose of extracting and transmitting only useful image information. As such, even if it is theoretically possible to construct the fifth embodiment

without fixedness between its sensor and camera, that would not be the "normal and usual" form of the device, *In re Ackenbach*, 45 F.2d 437, 439 (C.C.P.A. 1930), because omitting such fixedness would thwart the embodiment's purpose, *see supra* 18, 32-33, 35. In other words, whether or not Numazaki's device must necessarily have the relevant fixedness in all possible circumstances, Numazaki inherently discloses the fixed limitation because Numazaki's "disclosure is sufficient to show that the natural result flowing from the operation *as taught* would result" in that characteristic. *Persion Pharms. LLC v. Alvogen Malta Operations Ltd.*, 945 F.3d 1184, 1191 (Fed. Cir. 2019) (emphasis added; internal quotation marks omitted); *cf. Hewlett-Packard Co. v. Mustek Sys., Inc.*, 340 F.3d 1314, 1326 (Fed. Cir. 2003) ("[A] prior art product that sometimes, but not always, embodies a claimed method nonetheless teaches that aspect of the invention."); *accord Software Rights Archive, LLC v. Facebook, Inc.*, 659 F. App'x 627, 642 (Fed. Cir. 2016).

At least in the context of this case—where Gesture Technology itself argued with respect to the fixed limitation based on what Numazaki would have "suggest[ed]" to a skilled artisan, Appx377; *accord* Appx308; Appx2002 ¶ 71—the way in which a skilled artisan

would have naturally implemented the fifth embodiment given its purpose deserves consideration. *See Arbutus Biopharma Corp. v. ModernaTX, Inc.*, 65 F.4th 656, 664-65 (Fed. Cir. 2023) (obviousness-context inherency shown because "a person skilled in the art would follow" prior-art disclosures to create something with the claimed property); *see also Ackenbach*, 45 F.2d at 439 (a process may be "anticipated by a mechanism which might, with slight alterations, be adapted to carry out that process" if "such use of it *would have occurred to one whose duty it was to make practical use of the mechanism described*" (emphasis added)).

II. The Board Erroneously Determined That Apple Had Not Shown Claims 4, 11, And 18 Unpatentable By Improperly Failing To Consider Material Evidence.

If nothing else, the Board's determination that Apple had not established the obviousness of the fixed limitation in view of Numazaki rested on an improper "fail[ure] to consider material evidence." *Ultratec, Inc. v. CaptionCall, LLC*, 872 F.3d 1267, 1272, 1275 (Fed. Cir. 2017); *accord Altaire Pharms., Inc. v. Paragon Bioteck, Inc.*, 889 F.3d 1274, 1285 (Fed. Cir. 2018), *remand order modified by stipulation*, 738 F. App'x 1017 (Fed. Cir. 2018). The Board staked its assessment on

only one fact—namely, "the mere fact" that the sensor and camera of Numazaki's fifth embodiment "are arranged in parallel and have overlapping fields of view." Appx34. As the Board put it, "*[w]ithout more, the mere fact* that [the sensor] and camera … are arranged in parallel and have overlapping fields of view does not establish that the structures are [relevantly] fixed." Appx34 (emphasis added). That reasoning impermissibly ignored more in the record—expert testimony from both sides—that bore on the issue. § II.A. Nor can the Board's cryptic remarks characterizing the petition prop up this disregard. § II.B.

A. The Board wrongly ignored material evidence.

The Board improperly failed to account for two key pieces of evidence. First, the Board ignored Apple's supplemental expert declaration explaining that, in light of the fifth embodiment's "intended purpose," the claimed fixedness follows from the embodiment's undisputed sensor-and-camera configuration. Appx1784 ¶ 15; *see* Appx1782-1784 ¶¶ 13-14 (explaining that, "to perform the basic function" of the fifth embodiment, the sensor and camera "must have and maintain" their relative positions; "[w]ere one to move in relation to

the other, it would no longer be possible for the output of [the sensor] to define which portions of the camera … output should be retained"); *see also supra* 17-18, 35. Second, the Board ignored Gesture Technology's expert's dual agreement that: (1) "[t]o satisfy the intended purpose" of Numazaki's sensor and camera in the context of the fifth embodiment, Numazaki "requires" those components to "retain overlapping fields of view," Appx1809; and (2) "[f]ixing" those components would "ensure[]" that result, Appx1810. *See supra* 17-18, 35.

Separately and together, this testimony from both sides' experts was material, and thus the Board had an obligation to consider it. *See Altaire*, 889 F.3d at 1285 ("'[A]n agency's refusal to consider evidence bearing on the issue before it is, by definition, arbitrary and capricious within the meaning of 5 U.S.C. § 706.… [T]he agency must take account of all the evidence of record, including that which detracts from the conclusion the agency ultimately reaches.'" (quoting *Aqua Prods., Inc. v. Matal*, 872 F.3d 1290, 1325 (Fed. Cir. 2017) (en banc) (plurality opinion))); *accord PPC Broadband*, 739 F. App'x at 619, 624 (collecting cases). The testimony cemented the obviousness of the fixed limitation as a matter of what a skilled artisan would have understood from

Numazaki. *See supra* 31-36. And, even to the extent inherent disclosure was the sole issue at hand, the testimony was meaningful because it permitted a finding that the fixed limitation was necessarily present in Numazaki or at least the natural result of Numazaki's disclosures. *See supra* 42-45.

The Board, however, failed to give the relevant portions of either expert's testimony any consideration. To be sure, the Board nominally referenced the evidence in its bare recitation of the parties' arguments. *See* Appx33-34. But that was not enough: "The Board's *own explanation* must suffice." *Merck Sharp & Dohme Corp. v. Wyeth LLC*, 792 F. App'x 813, 815 (Fed. Cir. 2019) (emphasis added; brackets and internal quotation marks omitted); *see TRUSTID, Inc. v. Next Caller, Inc.*, No. 20-1950, 2021 WL 4427918, at *8 (Fed. Cir. Sept. 27, 2021) ("not sufficient" for the Board to simply "'summarize and reject arguments'" (quoting *In re NuVasive, Inc.*, 842 F.3d 1376, 1383 (Fed. Cir. 2016))). And the Board's affirmative explanation was explicitly founded on consideration of only "the mere fact"—"[w]ithout more"—that the fifth embodiment's sensor and camera are positioned in parallel with overlapping fields of view. Appx34.

Indeed, the Board confirmed the narrow evidentiary basis of its evaluation in the sentences following its "mere fact" statement. The Board noted that Apple had pointed to its expert testimony, Appx34, but the Board then failed to address that testimony on the merits, instead pivoting to an obscure assertion that "[t]he Petition … does not reference any such analysis," Appx34-35.

B. The Board's characterization of the petition cannot salvage the agency's disregard of material evidence.

To the extent that the Board's unelaborated remarks regarding how "[t]he Petition … does not reference" an analysis by Apple's expert, Appx34-35, can be construed as a ruling informally excluding Apple's supplemental expert declaration, such an exclusion was an abuse of discretion. Moreover, regardless of any exclusion of *Apple's* expert testimony, the Board's resolution of the fixed limitation at least hinged on an improper failure to consider relevant evidence because the Board also ignored *Gesture Technology's* expert testimony. For either or both reasons, the Board's remarks on the petition's content cannot ward off the agency's error in disregarding material evidence.

1. Excluding Apple's supplemental expert declaration would have been an abuse of discretion for multiple separate reasons.

To start, each of the three independent reasons that the Board's remarks regarding the petition cannot justify the Board's singular focus on inherency, discussed above (at 39-42), applies equally here.

First, Apple's supplemental expert declaration expanded upon and clarified the petition's obviousness theory, and Apple was entitled to present such confirmatory and crystalizing evidence. *See supra* 39-40; *see also AMC Multi-Cinema, Inc. v. Fall Line Pats., LLC*, No. 21-1051, 2021 WL 4470062, at *6, *8 (Fed. Cir. Sept. 30, 2021) ("reply material that fairly adds confirmation that the [petition's] initially presented material does in fact support the assertion [that a claim requirement is met] is not prohibited new material, but a proper part of the record"; holding that the Board abused its discretion in ignoring such a supplemental expert declaration); *Apple*, 949 F.3d at 704-07 (holding that the Board abused its discretion in putting aside a petitioner's reply argument, including a reply expert declaration, because the reply material was not "impermissible new matter" but rather "responsive to arguments originally raised in [the] petition").

Second, the declaration responded to an argument Gesture Technology made regarding what a skilled artisan would have

understood from Numazaki, and Apple had the right to present such responsive evidence, too. *See supra* 40-41; *see also Altaire*, 889 F.3d at 1285 (holding that the Board abused its discretion in failing to consider a second expert declaration, submitted by petitioner on reply, that "'responded to arguments raised in the corresponding patent owner response'" (quoting 37 C.F.R. § 42.23(b); citing 5 U.S.C. § 556(d); cleaned up)); *Apple*, 949 F.3d at 706-07 ("'[T]he petitioner in an inter partes review proceeding may introduce new evidence after the petition stage if the evidence is a legitimate reply to evidence introduced by the patent owner.'" (quoting *Anacor Pharms., Inc. v. Iancu*, 889 F.3d 1372, 1380 (Fed. Cir. 2018))).

Third, the Board's articulated basis for its characterization of the petition was legally erroneous. *See supra* 41-42. The Board opined that Apple was required, in its petition, to present expert testimony in support of the fixed limitation's obviousness, *see* Appx34, but there is "[n]o rule" to that effect, *Belden*, 805 F.3d at 1079; *see supra* 41-42; *cf. Valmont Indus., Inc. v. Lindsay Corp.*, 730 F. App'x 918, 922-23 (Fed. Cir. 2018) ("No statutes or rules prohibit a petitioner from submitting additional evidence after the petition.").

Finally, excluding Apple's supplemental declaration would be an abuse of discretion for an additional reason: The Board at least had to consider the declaration in the context of the issue of inherency. The Board reached whether the fixed limitation was inherent in Numazaki, *see* Appx34-35, and the declaration was material to that question, *see supra* 42-45, 48. The Board thus abused its discretion in "assign[ing]" the declaration "no weight"; "'the agency must take account of all the evidence of record, including that which detracts from the conclusion the agency ultimately reaches.'" *Altaire*, 889 F.3d at 1285 (quoting *Aqua Prods.*, 872 F.3d at 1325); *see supra* 47.

2. Irrespective of whether the Board could have put aside *Apple's* supplemental expert declaration, the Board's failure to factor in *Gesture Technology's* expert's concessions cannot be countenanced.

As an initial matter, the Board's characterization of the petition did not purport to say anything about Gesture Technology's expert's testimony. *See* Appx34-35. So, even if the characterization is construed as an exclusion, on its face the exclusion would not exclude Gesture Technology's expert testimony. Nor can this Court exclude that testimony in the first instance. This Court "may not supply" a basis for

an "agency's action" that "the agency itself has not given," let alone create an agency action that the agency never took. *Motor Vehicle Mfgs. Assoc. of the U.S., Inc. v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983) (internal quotation marks omitted); *accord SEC v. Chenery Corp.*, 318 U.S. 80, 93-94 (1943) ("[Agency] action must be measured by what the [agency] did, not by what it might have done.").

Moreover, the testimony could not be lawfully excluded in any event. The Board has no general-purpose license to ignore relevant evidence. *Altaire*, 889 F.3d at 1285; *supra* 47. As such, barring some rule or regulation permitting the Board to exclude a party's admissions from being used against it—and there is none—the Board had to consider Gesture Technology's expert's concessions as to the purpose of the fifth embodiment's sensor and camera and how fixing those components would ensure that purpose. *See* 5 U.S.C. § 556(d) (entitling a party to "to submit rebuttal evidence" and "to conduct such cross-examination as may be required for a full and true disclosure of the facts"); *cf. Cutino v. Nightlife Media, Inc.*, 575 F. App'x 888, 891 (Fed. Cir. 2014) (holding that the Trademark Trial and Appeal Board "committed legal error in ignoring the evidentiary effect of Applicant's

admissions"); *Newell Cos. v. Kenney Mfg. Co.*, 864 F.2d 757, 767 (Fed. Cir. 1988) (explaining that juries are not "free to discard probative admissions and undisputed facts"). After all, those concessions were material to both the obviousness and the inherency of the fixed limitation. *See supra* 47-48.

III. Reversal Or At Least Vacatur Is Warranted.

Given the Board's errors in constraining its obviousness analysis to inherency and failing to consider relevant evidence, this Court should reverse or vacate the Board's decision as to claims 4, 11, and 18. Vacatur is the bare minimum because, as explained in the preceding substantive discussion of the errors that the Board committed, each error was material if not absolutely controlling. *See, e.g.*, *Rovalma*, 856 F.3d at 1024 (a Board decision's "deficiencies call for a vacatur" when this Court is "not prepared to reach a bottom-line judgment").

Reversal is on the table because the Board erred in considering obviousness only in terms of inherency, rather than in terms of Apple's and Gesture Technology's presentations regarding conventional obviousness. Reversal is "require[d]" when, after correcting the Board's analysis, "there is only one permissible factual finding." *Corning v. Fast*

Felt Corp., 873 F.3d 896, 903 (Fed. Cir. 2017); *accord Intel Corp. v. PACT XPP Schweiz AG*, No. 22-1139, 2023 WL 2198653, at *6 (Fed. Cir. Feb. 24, 2023); *Intel Corp. v. Qualcomm Inc.*, No. 20-2092, 2022 WL 880681, at *4 (Fed. Cir. Mar. 24, 2022); *Belden*, 805 F.3d at 1077; *Smith & Nephew, Inc. v. Rea*, 721 F.3d 1371, 1373 (Fed. Cir. 2013). Just so here if the obviousness inquiry extends beyond inherent disclosure: As a matter of ordinary obviousness, the only reasonable conclusion is that a skilled artisan reading Numazaki would have arrived at the fixed limitation.

The record—with or without Apple's supplemental expert declaration—is one-sided on this score. Gesture Technology's only arguments on the fixed limitation were devoted to strictly limiting Numazaki to its disclosure of parallelism and fields-of-view overlap as between the fifth embodiment's sensor and camera. *See* Appx308-309 (patent owner response); Appx375-377 (sur-reply). That blinkered approach improperly ignored context. *See supra* 33-34 & n.4; *Intel*, 817 F. App'x at 1017; *Bradium*, 923 F.3d at 1049; *cf.* Appx377 (Gesture Technology itself recognizing that the issue was what Numazaki "suggest[ed]"). Namely, that approach disregarded the fifth

embodiment's disclosed purpose and how, when this purpose is coupled with the undisputed configuration of the fifth embodiment's sensor and camera, Numazaki implies or suggests the fixed limitation, such that a skilled artisan reading the reference would have readily perceived its teaching of the fixedness claimed. *See supra* 18, 32-33, 35, 46-47. Even Gesture Technology's expert conceded that fixing the sensor and camera would further the fifth embodiment's purpose, punctuating the fixed limitation's obviousness. *See supra* 47 (citing Appx1809-1810).

To be sure, Gesture Technology's expert also asserted—in a single sentence devoid of explanation—that whether the fifth embodiment's sensor and camera would maintain overlapping fields of view if moved "depend[s] on the amount of movement." Appx1809; *cf. TQ Delta, LLC v. CISCO Sys., Inc.*, 942 F.3d 1352, 1358 (Fed. Cir. 2019) ("Conclusory expert testimony does not qualify as substantial evidence."). But even if this cursory assertion could be credited, the possibility that *some* amount of overlap *could* be maintained in the face of minimal movement can hardly defeat the suggestion, apparent in Numazaki, to fix its sensor and camera relative to each other to *ensure* the overlap *necessary* for the fifth embodiment's purpose. *See Google LLC v.*

Koninklijke Philips N.V., 795 F. App'x 840, 844-46 (Fed. Cir. 2020) (reversing the Board and holding that a limitation would have been obvious when there was "no reasonable dispute … that a skilled artisan would know" that the limitation was a "readily achievable option" within the context of a prior-art reference and that the option would "often … serve the [reference's] undisputed goal"); *cf. Dome Patent L.P. v. Lee*, 799 F.3d 1372, 1381 (Fed. Cir. 2015) (a claim may be invalid for obviousness even if alternatives were available; even a teaching away need not defeat obviousness). There is "no reasonable dispute" that fixing the fifth embodiment's sensor and camera was "readily achievable" and would "serve [Numzaki]'s undisputed goal." *Google*, 795 F. App'x at 844-46. Being able to maintain a consistent overlap between outputs has clear virtues in helping the embodiment perform its image-extraction function. Indeed, nothing in Numazaki supports the idea that the moving and partial overlap that Gesture Technology's expert speculated about would work as a practical matter (though, as just explained, obviousness is compelled regardless). *See generally* Appx838-984 (Numazaki); *see also* Appx885 (Numazaki's Figure 48 depicting complete overlap).

Reversal is thus appropriate: Gesture Technology's expert's conclusory (or at least inapposite) contention regarding the possibility of movement cannot create room for a finding that the fixed limitation would not have been obvious in light of Numazaki. *See, e.g.*, *W. Union Co. v. MoneyGram Payment Sys., Inc.*, 626 F.3d 1361, 1371-72 (Fed. Cir. 2010) (reversing a judgment of nonobviousness because the at-issue limitations—including "additional limitations" of dependent claims that "add[ed] only trivial improvements"—would have been obvious as "a matter of common sense to a person of ordinary skill in the art").

CONCLUSION

For the reasons discussed above, this Court should reverse or vacate the Board's determination that Apple did not prove claims 4, 11, and 18 unpatentable. As Apple will explain in its response-reply brief, this Court should affirm the Board's decision in all other respects.

August 7, 2023

Respectfully submitted,

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ADDENDUM

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Paper 24
Entered: December 5, 2022

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC., LG ELECTRONICS, INC., LG ELECTRONICS U.S.A., INC., AND GOOGLE LLC
Petitioner,

v.

GESTURE TECHNOLOGY PARTNERS, LLC,
Patent Owner.

IPR2021-00921[1]
Patent 8,878,949 B2

Before PATRICK R. SCANLON, BRENT M. DOUGAL, and SCOTT RAEVSKY, *Administrative Patent Judges.*

SCANLON, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining Some Challenged Claims Unpatentable
35 U.S.C. § 318(a)

[1] IPR2022-00092 (LG Electronics, Inc. and LG Electronics U.S.A., Inc.) and IPR2022-00362 (Google LLC) have been joined with this proceeding.

I. INTRODUCTION

Apple Inc., LG Electronics, Inc., LG Electronics U.S.A., Inc., and Google LLC (collectively "Petitioner") challenge claims 1–18 of U.S. Patent No. 8,878,949 B2 (Ex. 1001, "the '949 patent"). We have jurisdiction under 35 U.S.C. § 6, and this Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–3, 5–10, and 12–17 of the '949 patent are unpatentable but has not shown by a preponderance of the evidence that claims 4, 11, and 18 are unpatentable.

A. Procedural History

Apple Inc. filed a Petition (Paper 1, "Pet.") requesting an *inter partes* review of the challenged claims. Gesture Technology Partners, LLC ("Patent Owner") filed a Preliminary Response (Paper 6).

We instituted a trial as to all challenged claims. Paper 8 ("Decision on Institution" or "Dec. Inst.").

After institution, LG Electronics, Inc. and LG Electronics U.S.A., Inc. filed a petition and a motion for joinder to this proceeding. IPR2022-00092, Papers 1, 3. We granted the motion for joinder, and IPR2022-00092 was joined with this proceeding and dismissed. Paper 12, 11–12. In addition, Google LLC filed a petition and a motion for joinder to this proceeding. IPR2022-00362, Papers 2, 3. We granted the additional motion for joinder, and IPR2022-00362 was joined with this proceeding and dismissed. Paper 16, 5–6. Consequently, Apple Inc., LG Electronics, Inc., LG Electronics U.S.A., Inc., and Google LLC are joined in this proceeding.

Patent Owner filed a Patent Owner Response (Paper 10, "PO Resp."), Petitioner filed a Reply (Paper 13, "Reply"), and Patent Owner filed a Sur-reply (Paper 14, "Sur-reply").

Petitioner relies on the Declaration of Dr. Benjamin B. Bederson (Ex. 1003) and the Supplemental Declaration of Dr. Benjamin B. Bederson (Ex. 1018) in support of its contentions. Patent Owner relies on the Declaration of Benedict Occhiogrosso (Ex. 2002) in support of its contentions.

An oral hearing was held on September 14, 2022. A transcript of the hearing is included in the record. Paper 23 ("Tr.").

B. Real Parties in Interest

Petitioner identifies Apple Inc., LG Electronics, Inc., LG Electronics U.S.A., Inc., and Google LLC as the real parties in interest. Pet. 65; IPR2022-00092, Paper 1, 62; IPR2022-00362, Paper 1, 61. Patent Owner identifies itself as the real party in interest. Paper 15, 1.

C. Related Matters

The parties identify the following proceedings as related matters involving the '949 patent: *Gesture Technology Partners, LLC v. Apple Inc.*, No. 6:21-cv-00121 (W.D. Tex.); *Gesture Technology Partners, LLC v. Lenovo Group Ltd.*, No. 6:21-cv-00122 (W.D. Tex.); *Gesture Technology Partners, LLC v. LG Electronics, Inc.*, No. 6:21-cv-00123 (W.D. Tex.); *Gesture Technology Partners, LLC v. Huawei Device Co., Ltd.*, No. 2:21-cv-00040 (E.D. Tex.); *Gesture Technology Partners, LLC v. Samsung Electronics Co., Ltd.*, No. 2:21-cv-00041 (E.D. Tex.), *Gesture Technology Partners, LLC v. Motorola Mobility LLC*, No. 1:22-cv-03535 (N.D. Ill.), and *Gesture Technology Partners, LLC v. Katherine K. Vidal*, No. 1:22-cv-622 (E.D. Va.).. Pet. 65; Paper 15, 1–3.

In addition, Patent Owner identifies the following *inter partes* review proceedings as related matters: IPR2021-00917; IPR2021-00920; IPR2021-00922; and IPR2021-00923. Paper 15, 2–3. Patent Owner also identifies the following related *Ex Parte* Reexaminations: No. 90/014,900; No. 90/014,901; No. 90/014,902; and No. 90/014,903. *Id.* at 3–4.

D. The '949 Patent

The '949 patent, titled "Camera Based Interaction and Instruction," issued November 4, 2014, with claims 1–18. Ex. 1001, codes (45), (54), 15:21–16:50. The '949 patent relates to "enhanc[ing] the quality and usefulness of picture taking for pleasure, commercial, or other business purposes." *Id.* at 1:4–6. In one embodiment, "stereo photogrammetry is combined with digital image acquisition to acquire or store scenes and poses of interest, and/or to interact with the subject in order to provide data to or from a computer." *Id.* at 1:6–10.

Figure 2A of the '949 patent is reproduced below.

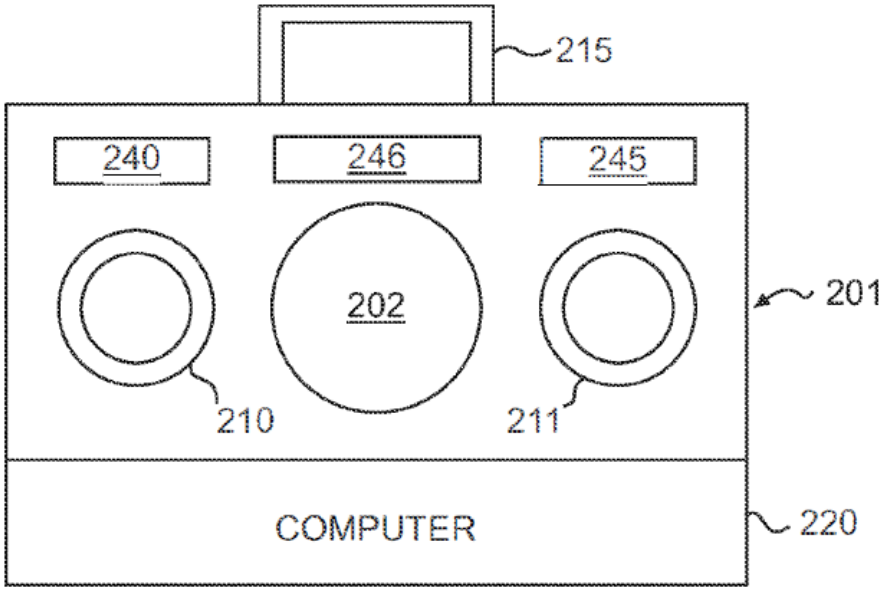

FIG. 2A

Figure 2A illustrates still camera system 201, which includes central camera 202 having high resolution and color accuracy for picture taking. *Id.* at 4:66–5:2. Camera system 201 also includes two cameras 210, 211 on either side of central camera 202. *Id.* at 5:2–3. Cameras 210, 211 "may be lower resolution (allowing lower cost, and higher frame rate, as they have less pixels to scan in a given frame time), with little or no accurate color capability, as they are used to simply see object positions or special datum positions on objects." *Id.* at 5:3–7.

Camera system 201 further includes computer 220 that processes data from cameras 210, 211 "to get various position and/or orientation data concerning a person." *Id.* at 5:24–26. "In general, one can use the system to automatically 'shoot' pictures" in response to a particular event, such as the subject undertaking a particular position or gesture—i.e., a silent command to take a picture. *Id.* at 5:30–49.

E. Challenged Claims

As noted above, Petitioner challenges claims 1–18 of the '949 patent. Claims 1, 8, and 13 are independent. Claim 1 is illustrative of the claimed subject matter and is reproduced below:

> 1. A portable device comprising:
>
> a device housing including a forward facing portion, the forward facing portion of the device housing encompassing an electro-optical sensor having a field of view and including a digital camera separate from the electro-optical sensor; and
>
> a processing unit within the device housing and operatively coupled to an output of the electro-optical sensor, wherein the processing unit is adapted to:

> determine a gesture has been performed in the electro-optical sensor field of view based on the electro-optical sensor output, and
>
> control the digital camera in response to the gesture performed in the electro-optical sensor field of view, wherein the gesture corresponds to an image capture command, and wherein the image capture command causes the digital camera to store an image to memory.

Ex. 1001, 15:21–38.

F. Instituted Grounds of Unpatentability

We instituted *inter partes* review of the challenged claims based on the following grounds of unpatentability asserted by Petitioner:[2]

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
1–18	103(a)	Numazaki,[3] Nonaka[4]
6, 12, 17	103(a)	Numazaki, Nonaka, Aviv[5]

Dec. Inst. 27; Pet. 6–7.

II. ANALYSIS

A. Legal Standards

To prevail in its challenge, Petitioner must demonstrate by a preponderance of the evidence that the claims are unpatentable. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d) (2020). "In an IPR, the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable." *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363

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[2] The Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) ("AIA"), amended 35 U.S.C. § 103. Because the '949 patent has an effective filing date before the March 16, 2013, effective date of the applicable AIA amendments, we apply the pre-AIA version of 35 U.S.C. § 103.
[3] US 6,144,366, issued Nov. 7, 2000 (Ex. 1004).
[4] JP H4-73631, published Mar. 9, 1992 (Ex. 1005).
[5] US 5,666,157, issued Sept. 9, 1997 (Ex. 1006).

(Fed. Cir. 2016) (citing 35 U.S.C. § 312(a)(3) (2012) (requiring *inter partes* review petitions to identify "with particularity . . . the evidence that supports the grounds for the challenge to each claim")). This burden of persuasion never shifts to the patent owner. *See Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015) (discussing the burden of proof in *inter partes* review).

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when in evidence, objective indicia of non-obviousness (also called secondary considerations), such as commercial success, long-felt but unsolved needs, and failure of others. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). We analyze grounds based on obviousness in accordance with the above-stated principles.

B. Level of Ordinary Skill in the Art

In determining whether an invention would have been obvious at the time it was made, 35 U.S.C. § 103 requires us to resolve the level of ordinary skill in the pertinent art at the time of the effective filing date of the claimed invention. *Graham*, 383 U.S. at 17. The person of ordinary skill in the art is a hypothetical person who is presumed to have known the relevant art. *In re GPAC, Inc.*, 57 F.3d 1573, 1579 (Fed. Cir. 1995). Factors that may be considered in determining the level of ordinary skill in the art

include, but are not limited to, the types of problems encountered in the art, the sophistication of the technology, and educational level of active workers in the field. *Id.* In a given case, one or more factors may predominate. *Id.*

Petitioner contends that a person having ordinary skill in the art "would have had at least a bachelor's degree in electrical engineering or equivalent with at least one year of experience in the field of human computer interaction," and "[a]dditional education or experience might substitute for the above requirements." Pet. 5–6 (citing Ex. 1003 ¶¶ 29–31). Patent Owner does not dispute Petitioner's definition for the purposes of its Response. PO Resp. 5.

Based on our review of the record before us, we determine that Petitioner's stated level of ordinary skill in the art is reasonable because it is consistent with the evidence of record, including the asserted prior art. Accordingly, for the purposes of this Decision, we adopt Petitioner's definition.

C. Claim Construction

In *inter partes* reviews, the Board interprets claim language using the district-court-type standard, as described in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). *See* 37 C.F.R. § 42.100(b). Under that standard, we generally give claim terms their ordinary and customary meaning, as would be understood by a person of ordinary skill in the art at the time of the invention, in light of the language of the claims, the specification, and the prosecution history. *See Phillips*, 415 F.3d at 1313–14. Although extrinsic evidence, when available, may also be useful when construing claim terms under this standard, extrinsic evidence should be considered in the context of the intrinsic evidence. *See id.* at 1317–19.

Petitioner proposes claim constructions for the phrases "the image capture command causes the digital camera to store an image to memory" in claim 1, "capturing an image to the digital camera in response to . . . the image capture command" in claim 8, and "correlate the gesture detected . . . with an image capture function and subsequently capture an image using the digital camera" in claim 13. Pet. 8. Specifically, Petitioner asserts that these phrases "should be construed broadly enough to encompass capturing/storing video or still images," and provides reasons supporting its assertion. *Id.* at 8–10. Patent Owner does not contest Petitioner's proposed claim constructions. PO Resp. 5. We agree with Petitioner's supporting reasoning and accordingly adopt Petitioner's proposed claim constructions.

D. Asserted Obviousness Based on Numazaki and Nonaka

Petitioner asserts that claims 1–18 of the '949 patent are unpatentable under 35 U.S.C. § 103(a) based on Numazaki and Nonaka. Pet. 10–49. Patent Owner provides arguments addressing this asserted ground of unpatentability. PO Resp. 6–29. We first summarize the references and then address the parties' contentions.

1. Numazaki

Numazaki "relates to a method and an apparatus for generating information input in which input information is extracted by obtaining a reflected light image of a target object." Ex. 1004, 1:8–11. An information input generation apparatus according to a first embodiment includes lighting unit 101, reflected light extraction unit 102, feature data generation unit 103, and timing signal generation unit 104. *Id.* at 10:23–28, Fig. 1. Light emitting unit 101 emits light that varies in intensity in time according to a timing signal from timing signal generation unit 104. *Id.* at 10:29–31. The light is directed onto a target object, and light reflected from the target object

is extracted by reflected light extraction unit 102. *Id.* at 10:31–35. Feature data generation unit 103 extracts feature data from the reflected light image. *Id.* at 10:57–58. "When the target object is a hand, it becomes possible to obtain the information regarding a gesture or a pointing according to the feature data extracted from the reflected light image of the hand, for example, and it becomes possible to operate a computer by using this obtained information." *Id.* at 10:61–66.

Figure 2, reproduced below, depicts a detailed block diagram of the information input generation apparatus of the first embodiment. *Id.* at 5:11–12, 11:9–11.

FIG.2

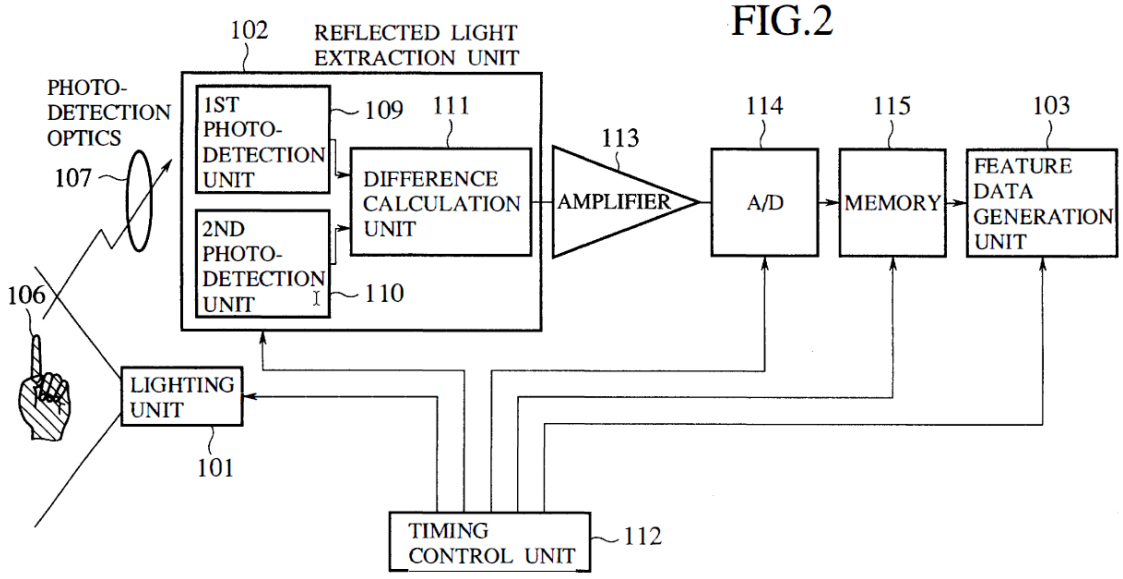

Figure 2 shows that light emitted from lighting unit 101 is reflected by target object 106, such that an image is formed on a photo-detection plane of reflected light extraction unit 102. *Id.* at 11:11–14. Reflected light extraction unit 102 includes first photo-detection unit 109, second photo-detection unit 110, and difference calculation unit 111. *Id.* at 11:16–19. Timing control unit 112 causes lighting unit 101 to emit light when first photo-detection unit 109 is in a photo-detecting state and not to emit light

when second photo-detection unit 110 is in a photo-detecting state. *Id.* at 11:26–32. Accordingly, first photo-detection unit 109 receives the light emitted from lighting unit 101 that is reflected by target object 106 and external light, such as illumination light or sunlight, but second photo-detection unit 110 receives the external light only. *Id.* at 11:33–39.

Difference calculation unit 111 calculates and outputs the difference between the image detected by first photo-detection unit 109 and the image detected by second photo-detection unit 110, which difference corresponds to the light emitted from lighting unit 101 that is reflected by target object 106. *Id.* at 11:43–55. The output from reflected light extraction unit 102 is amplified by amplifier 113, converted from analog signals into digital signals by analog-to-digital converter 114, and stored at memory 115. *Id.* at 11:61–64. At an appropriate time, the data stored in memory 115 is read out and processed by feature data generation unit 103. *Id.* at 11:64–66.

Numazaki also discloses a third embodiment that "is directed to another exemplary case of the feature data generation unit of the first embodiment, which realizes a gesture camera for recognizing the hand action easily and its application as a pointing device in the three-dimensional space." *Id.* at 29:4–8. Figure 23, reproduced below, shows the feature data generation unit of the third embodiment. *Id.* at 6:4–6, 29:9–10.

FIG.23

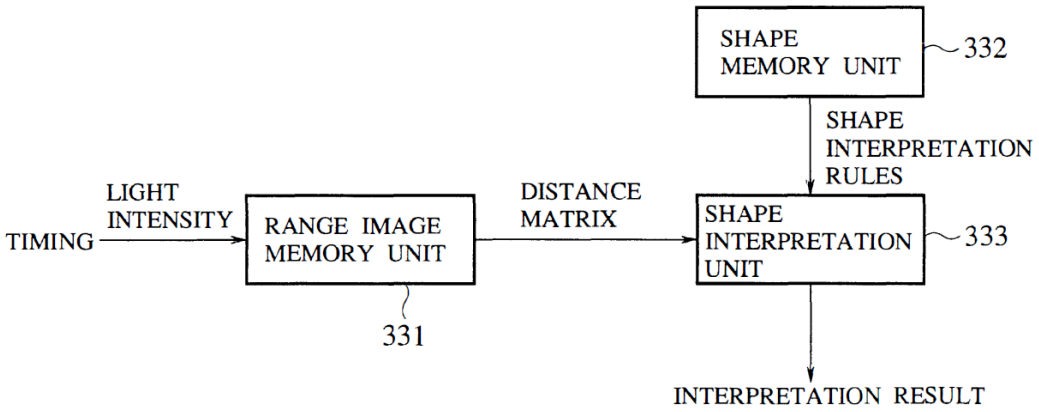

Figure 23 shows that the feature data generation unit includes range image memory unit 331 for storing a distance matrix, shape memory unit 332 for storing shape interpretation rules, and shape interpretation unit 333 for interpreting a shape of the distance matrix according to the shape interpretation rules. *Id.* at 29:11–18. Shape interpretation unit 333 performs the processing for determining if a matching shape interpretation rule exists. *Id.* at 29:28–38, Fig. 25. When a matching shape is found, a command corresponding to that shape is outputted. *Id.* at 30:2–3. Thus, this embodiment uses hand gesture recognition as a trigger for inputting a command into a computer and can also be used to power on and off a device such as a TV or lighting equipment. *Id.* at 31:3–10.

In addition, Numazaki discloses a fifth embodiment that "is directed to another exemplary case of the feature data generation unit in the first embodiment" that uses a video compression technique that extracts only useful image information to lower communications costs. *Id.* at 39:6–20. Figure 46, reproduced below, shows the feature data generation unit according to the fifth embodiment. *Id.* at 7:4–6, 39:21–23.

FIG.46

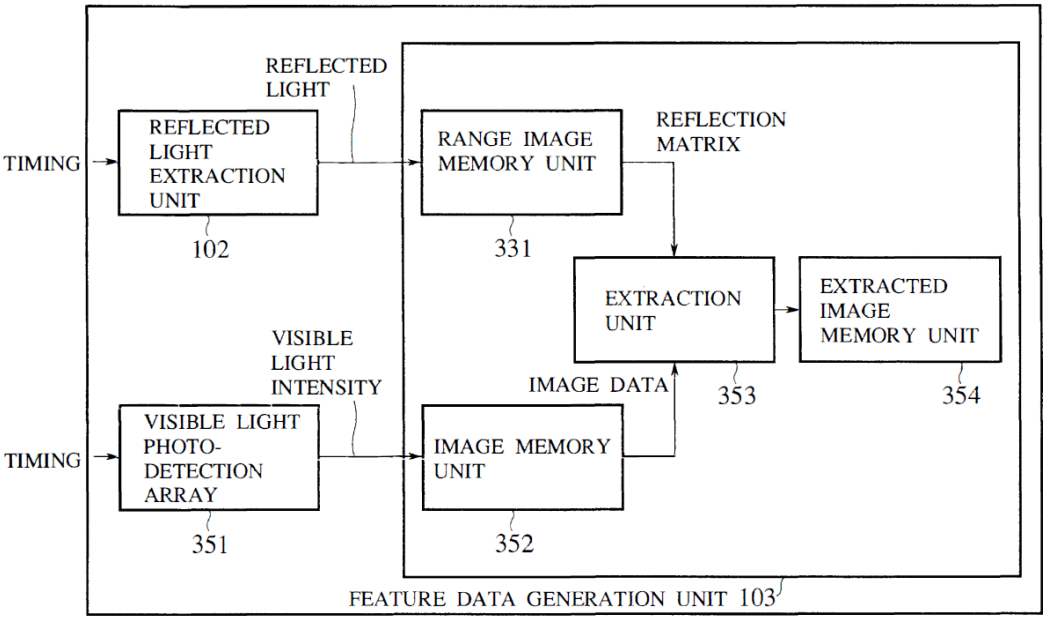

Figure 46 shows feature data generation unit 103 in conjunction with reflected light extraction unit 102 and visible light photo-detection array 351, which is generally a CCD camera for taking video images. *Id.* at 39:24–41. Images captured by visible light photo-detection array 351 are stored in image memory unit 352, and a mask (i.e., the image detected by reflected light extraction unit 102) is stored in range image memory unit 331. *Id.* at 39:51–57. Extraction unit 353 superposes the original image and the mask, leaving only the overlapping portion. *Id.* at 39:57–59.

Numazaki also discloses an eighth embodiment that "is directed to a system configuration incorporating the information input generation apparatus" described in the previous embodiments. *Id.* at 50:21–24. Figure 74, reproduced below, shows a computer equipped with the information input generation apparatus. *Id.* at 8:31–34, 50:25–26.

FIG.74

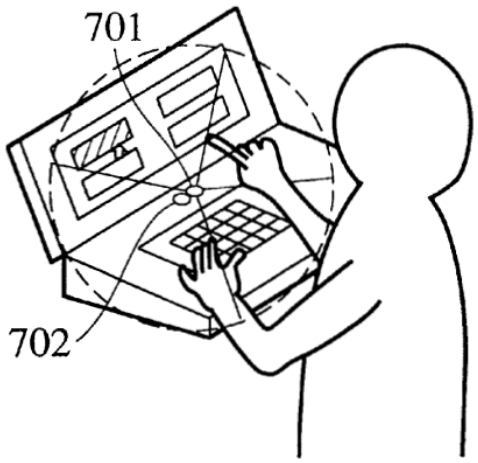

Figure 74 depicts a portable computer having a keyboard and a display integrated with the computer body. *Id.* at 50:26–29. Lighting unit 701 and photo-detection sensor unit 702 are positioned beyond the keyboard. *Id.* at 50:30–33.

2. Nonaka

Nonaka relates to a camera equipped with a remote release device. Ex. 1005, 2:1–3. In one embodiment, a "photographer gives a release instruction by means of a predetermined motion towards the camera in conjunction with the display timing of the aforementioned display patterns, the distance measurement device . . . detects this motion by the subject . . . , and [an] exposure is carried out." *Id.* at 3:35–38. Nonaka describes that an objective of this invention is to provide "a remote release device-equipped camera which enables remote release operations without using a transmitter or receiver to give a release instruction, thereby achieving a higher degree of freedom, good portability, and cost benefits." *Id.* at 2:26–29.

3. Independent Claim 1

Petitioner contends that the proposed combination of Numazaki and Nonaka discloses the limitations of challenged claim 1. Pet. 10–33. In particular, Petitioner relies on: (1) Numazaki's first embodiment as teaching using the reflected light extraction unit to detect an object such as a user's hand; (2) Numazaki's third embodiment as teaching detecting when the user has performed a pre-registered gesture by comparing the output of the reflected light extraction unit to stored data reflecting pre-registered gestures or hand positions and instructing the device to implement a command corresponding to the gesture; (3) Numazaki's fifth embodiment as teaching taking video images with visible light photo-detection array 351; and (4) Numazaki's eighth embodiment as teaching portable devices that implement the information input generation apparatus described in the other embodiments. *Id.* at 20 (citing Ex. 1004, 4:32–35, 29:19–30:5, 31:3–10, 39:21–60, 50:19–24). Regarding these embodiments, Petitioner argues that,

> [a]lthough *Numazaki* does not expressly describe combining all these features into a single portable device such that a user could perform a gesture command (pursuant to its third embodiment) that causes video capture to initiate (pursuant to its fifth embodiment), a [person having ordinary skill in the art] would have been motivated to implement *Numazaki's* portable device in this manner pursuant to *Nonaka's* image capture command gesture teachings.

Id. at 20–21. For example, Petitioner argues that combining Numazaki's embodiments as proposed would have improved Numazaki's portable devices in the same way that Nonaka's gesture-based image capture functionality benefits its camera device. *Id.* at 21 (citing Ex. 1003 ¶¶ 48–49; *KSR*, 550 U.S. at 417). That is, Petitioner argues that Nonaka's "gesture-based image capture solution 'achiev[es] a higher degree of freedom, good

portability, and cost benefits,'" and one of ordinary skill in the art "would have recognized that these same benefits would be realized in *Numazaki's* laptop." *Id.* (citing Ex. 1006, 2:26–29) (alteration in original). Petitioner also identifies certain passages in Numazaki and explains the significance of each passage with respect to the corresponding claim limitation. *Id.* at 25–33. We address below in turn the subject matter of each element of claim 1.

a) Preamble: "A portable device comprising"

For the preamble, Petitioner relies on Numazaki's eighth embodiment as teaching "a computer implemented method for controlling functions on a portable laptop device through gestures or pointing." Pet. 25–26 (citing Ex. 1004 50:38–43, Fig. 74). Patent Owner does not present arguments for this claim language. To the extent the preamble to claim 1 is limiting, we find, based on the complete record, that Petitioner has demonstrated by a preponderance of the evidence that the combination of Numazaki and Nonaka discloses this claim language.

b) Limitation [1(a)]: "a device housing including a forward facing portion, the forward facing portion of the device housing encompassing an electro-optical sensor having a field of view and including a digital camera separate from the electro-optical sensor"

Petitioner argues that one of ordinary skill in the art would have been motivated to implement the videoconference functionality of Numazaki's fifth embodiment into the laptop of the eighth embodiment. Pet. 26. To accomplish this implementation, Petitioner argues that Numazaki's two-camera reflected light extraction unit 102 would have been used in conjunction with visible light photo-detection array 351. *Id.* at 26–27 (citing Ex. 1004, 39:21–49). According to Petitioner, because the output of reflected light extraction unit 102 is processed to define which portions of

the video captured by visible photo-detection array 351 are retained, one of ordinary skill in the art would have understood that both reflected light extraction unit 102 and visible photo-detection array 351 are forward facing. *Id.* at 27–28 (citing Ex. 1004, 39:24–60, Fig. 48; Ex. 1003 ¶ 52). Petitioner also argues that reflected light extraction unit 102 corresponds to the claimed electro-optical sensor and visible light photo-detection array 351 corresponds to the claimed digital camera.[6] *Id.* at 28.

Patent Owner argues that one of ordinary skill in the art would not have understood Numazaki's reflected light extraction unit 102 to be the claimed electro-optical sensor because it comprises two separate cameras (i.e., photo-detection units 109, 110) and difference calculation unit 111. PO Resp. 8 (citing Ex. 2002 ¶ 45); *see also* Sur-reply 1 (citing Ex. 2002 ¶¶ 44–45) (asserting one of ordinary skill in the art "would not have understood the claimed 'electro-optical sensor' as having a 'difference calculation unit'").

We do not find this argument persuasive. Numazaki's reflected light extraction unit 102 includes first photo-detection unit 109, second photo-detection unit 110, and difference calculation unit 111. Ex. 1004, 11:16–19. Each of the first and second photo-detection units "detects the optical image formed on the photo-detection plane and converts it into image signals corresponding to the received light amounts." *Id.* at 11:20–23. Difference

[6] During the oral hearing, counsel for Petitioner argued that the "primary theory" set forth in the Petition is that reflected light extraction unit 102, as a whole, satisfies the claimed electro-optical sensor, but photo-detection units 109, 110, individually, also satisfy the claimed electro-optical sensor. Tr. 30:21–31:8. We do not address whether Numazaki's photo-detection units individually satisfy the claimed electro-optical sensor because that position is not asserted in the Petition.

calculation unit 111 calculates the difference between the images detected by the first and second photodetection units and outputs the obtained difference. *Id.* at 11:53–56. More specifically, "reflected light extraction unit 102 sequentially outputs the reflected light amount for each pixel of the reflected light image" as analog signals that are amplified by amplifier 113 and converted into digital signals by converter 114. *Id.* at 11:59–64. Numazaki's disclosure of reflected light extraction unit 102 thus describes a unit that senses light and converts the sensed light into electronic signals, which is consistent with the plain meaning of an "electro-optical sensor."[7] As such, we agree with Petitioner's assertion that reflected light extraction unit 102 satisfies the claimed electro-optical sensor.

Furthermore, in support of its position that reflected light extraction unit 102 is an electro-optical sensor as claimed, Petitioner contends that "although the '949 Patent does not define 'electro-optical sensor,' dependent claim 7 specifies that the sensor is either a 'CCD detector' or [a] 'CMOS detector.'" Pet. 28–29 (citing Ex. 1001, 15:50–52). Petitioner then asserts that Numazaki expressly discloses that reflected light extraction unit 102 has a photo-detection section comprising CMOS sensors or CCD image sensors. *Id.* at 29 (citing Ex. 1004, 12:56–57, 15:23–27). In addition, Patent Owner's expert, Mr. Occhiogrosso, acknowledges that photo-detection units 109, 110 are electro-optical sensors. Ex. 1019, 15:21–16:3. Accordingly, we determine based on the full record that Numazaki's reflected light extraction unit 102 provides an electro-optical sensing function.

[7] The '949 patent does not define "electro-optical sensor," and neither party proffers a construction of the term.

As discussed above, difference calculation unit 111 merely processes the image signals produced by the first and second photodetection units and does not alter the electro-optical sensing function of reflected light extraction unit 102. *See* Ex. 1004, 11:53–56. Accordingly, we are not persuaded that the inclusion of difference calculation unit 111 would have suggested to one of ordinary skill in the art that reflected light extraction unit 102 is not an electro-optical sensor.

Next, Patent Owner argues that the Petition wrongly contends that photo-detection sensor unit 702 in Figure 74 of Numazaki "is or includes" one or both of Numazaki's reflected light extraction unit 102 and visible light photo-detection array 351. PO Resp. 8 (citing Pet. 16, 17, 25–29; Ex. 2002 ¶ 46). According to Patent Owner, "*Numazaki* is silent regarding the 'photo-detection sensor unit' in Fig. 74 as being or including one or more of the 'reflected light extraction unit 102' and the 'visible light photo-detection array 351.'" *Id.* at 9 (citing Ex. 2002 ¶ 47). Patent Owner further argues that:

> The mere fact that *Numazaki's* eighth embodiment may "incorporate the information input generation apparatus" of *Numazaki's* fifth embodiment, Ex. 1004, 50:21–24, does not mean to a [person having ordinary skill in the art] that the "photodetection sensor unit" in Fig. 74 is or includes one or more of the "reflected light extraction unit 102" and the "visible light photo-detection array 351" from Fig. 46 (i.e., the claimed "electro-optical sensor" and "digital camera," respectively).

PO Resp. 10–11 (citing Ex. 2002 ¶ 49).

Petitioner replies by arguing that Patent Owner's argument mischaracterizes the proposed combination because "[t]he Petition did not suggest, nor does it depend on, Numazaki expressly teaching that the eighth

embodiment's laptop includes the fifth embodiment's components." Reply 4–5.

We agree with Petitioner on this issue. The Petition asserts that one of ordinary skill in the art would have been motivated to implement the videoconference functionality of Numazaki's fifth embodiment into the laptop of the eighth embodiment. Pet. 26. The Petition further asserts that this implementation would have been accomplished by using reflected light extraction unit 102 and visible photo-detection array 351 from Numazaki's fifth embodiment. *Id.* at 26–27 (citing Ex. 1004, 39:21–49, Fig. 46). Thus, rather than asserting that photo-detection sensor unit 702 of Numazaki's eighth embodiment "is or includes" one or both of reflected light extraction unit 102 and visible light photo-detection array 351, the Petition proposes modifying Numazaki's eighth embodiment by including the reflected light extraction unit and the visible light photo-detection array from Numazaki's fifth embodiment to provide videoconference functionality. *Id.* at 26–27; *see also id.* at 20–21 (arguing one of ordinary skill in the art would have been motivated to implement Numazaki's portable device "such that a user could perform a gesture command (pursuant to its third embodiment) that causes video capture to initiate (pursuant to its fifth embodiment)").

Accordingly, we do not find Patent Owner's argument persuasive. We also disagree with Patent Owner's argument that Petitioner's Reply argument seeks to change Petitioner's position with respect to Numazaki's fifth and eighth embodiments. *See* Sur-reply 2. Specifically, Patent Owner contests Petitioner's assertion regarding the Petition not suggesting that Numazaki expressly teaches that the eighth embodiment's laptop includes the fifth embodiment's components based on the statement in the Petition that Numazaki "expressly contemplates incorporating these early-described

embodiments in the eighth embodiment portable devices." *Id.* at 3 (citing Reply 5; Pet. 23). This statement, however, discusses *incorporating* aspects of the first seven embodiments *into* the eighth embodiment and does not indicate that the eighth embodiment includes any aspects of the early embodiments prior to any modification.

For the above reasons, we find on the complete record that Petitioner has demonstrated by a preponderance of the evidence that the combination of Numazaki and Nonaka discloses limitation [1(a)].

c) Limitation [1(b)]: "a processing unit within the device housing and operatively coupled to an output of the electro-optical sensor, wherein the processing unit is adapted to: determine a gesture has been performed in the electro-optical sensor field of view based on the electro-optical sensor output"

For limitation [1(b)], Petitioner argues that one of ordinary skill in the art would have been motivated to implement the gesture recognition of Numazaki's third embodiment into the eighth embodiment's laptop device. Pet. 29. Petitioner also argues that one of ordinary skill in the art "would have understood that *Numazaki's* third embodiment gesture detection process would be implemented by 'a processing unit' within *Numazaki's* laptop device and adapted (via software) to detect a user's gesture (or sequence of gestures)." *Id*. at 30 (citing Ex. 1004 ¶¶ 53–54).

Patent Owner argues that Numazaki discloses an information input generation apparatus (which Patent Owner refers to as "IIGA") that includes feature data generation unit 103. PO Resp. 12 (citing Ex. 1004, 5:10–12, Fig. 2). Patent Owner also argues that the IIGA in Numazaki's third embodiment is configured as "a gesture camera" by implementing the feature input generation apparatus (and feature data generation unit) depicted in Figure 23. *Id.* at 12–13 (citing Ex. 1004, 6:4–7, 29:4–10, Fig. 23;

Ex. 2002 ¶ 53). Patent Owner adds that the IIGA in Numazaki's fifth embodiment is configured as "a chromakey camera" by implementing the IIGA of Figure 2 with feature data generation unit 103 and visible light photo-detection array 351 depicted in Figure 46. *Id.* at 13–14 (citing Ex. 1004, 39:17–23, Fig. 46; Ex. 2002 ¶ 54). In Patent Owner's view, therefore, the feature data generation units of Figures 23 and 46 have different implementations and different specialized units depending on whether the IIGA is configured as a gesture camera or a chromakey camera. *Id.* at 14 (citing Ex. 1004, 29:4–10, 39:17–23).

In view of these assertions, Patent Owner argues that "the Petition requires that *Numazaki's* eighth embodiment laptop incorporate an IIGA configured as both a gesture camera and a chromakey camera" to meet both limitations [1(a)] and [1(b)], but "*Numazaki* does not disclose that the IIGA can be configured as both a 'gesture camera' and a 'chromakey camera.'" *Id.* at 14–15 (citing Ex. 2002 ¶¶ 55–56); *see also id.* at 16–17 (arguing that Numazaki does not disclose "an embodiment that uses the feature data generation unit of the first embodiment that has the gesture camera for recognizing hand action of the third embodiment and the chromakey camera for extracting only a specific target of the fifth embodiment").

We do not find this argument persuasive. Rather, we agree with Petitioner that Patent Owner again mischaracterizes the proposed combination. *See* Reply 9–10. Namely, the Petition does not assert that Numazaki discloses one embodiment of an information input generation apparatus that includes both a gesture camera and a chromakey camera. Instead, as discussed above, the Petition contends that it would have been obvious to one of ordinary skill in the art to modify the laptop of Numazaki's eighth embodiment to include the gesture recognition of the

third embodiment to initiate the video capture functionality of the fifth embodiment as suggested by Nonaka's image capture command gesture teachings. Pet. 20–21. By focusing on Numazaki's purported failure to disclose this configuration in a single embodiment, Patent Owner's argument fails to address the combination proposed in the Petition.

Regarding the proposed combination, Patent Owner argues that "Petitioner does not explain how the 'reflected light image' from the 'reflected light extraction unit 102' would be accessed by both 'shape interpretation unit 333' from the third embodiment and 'extraction unit 353' from the fifth embodiment" or "how these specialized units would operate simultaneously or whether different units would operate at different times or what that timing functionality would require." PO Resp. 16 (citing Ex. 2002 ¶ 58).

In reply, Petitioner argues that Patent Owner's argument "ignores the entire premise of the combination, which proposes the third embodiment is used as a trigger mechanism to initiate the fifth embodiment, setting forth precisely the timing relationship that Patent Owner demands." Reply 8. Specifically, Petitioner points to the assertion in the Petition that a person having ordinary skill in the art "would have been motivated to implement this gesture recognition as a means of allowing the user to initiate (or turn on) the fifth embodiment's videoconferencing functionality." *Id.* (quoting Pet. 31). Petitioner adds that Dr. Bederson confirms that the proposed combination uses the gesture recognition and videoconferencing processing separately and sequentially. *Id.* at 9 (citing Ex. 1018 ¶¶ 3–9).

In its Sur-reply, Patent Owner argues that this reply argument is the first time Petitioner explains the details of the proposed combination and should be disregarded as an improper attempt to correct a deficiency in the

Petition. Sur-reply 4–5. Patent Owner also disputes Petitioner's assertion that the Petition precisely sets forth the timing relationship of the gesture recognition videoconferencing functionalities in the proposed combination. *Id.* at 5.

We find that Petitioner's Reply argument is not beyond the proper scope of a reply because it directly responds to Patent Owner's argument that Petitioner does not explain how elements from both the third and fifth embodiments would accessed by the reflected light extraction unit and whether these elements would operate simultaneously or at different times. Moreover, Petitioner's Reply argument elaborates on the contentions in the Petition that the gesture recognition would be implemented as a means of allowing the user to initiate the fifth videoconferencing functionality. Pet. 31; *see Chamberlain Grp., Inc. v. One World Techs., Inc.*, 944 F. 3d, 919, 925 (Fed. Cir. 2019) ("Parties are not barred from elaborating on their arguments on issues previously raised."). Accordingly, we find that the Petition adequately explains how the reflected light extraction unit would be accessed by both the third embodiment's shape interpretation unit 333 and the fifth embodiment's extraction unit 353. We particularly credit Dr. Bederson's uncontroverted testimony that "it would be well within the capabilities of a [person having ordinary skill in the art] to utilize the same output by two separate processing blocks to implement the proposed combination," and one of ordinary skill in the art "would understand there are no technical barriers to arranging multiple distinct processing units that separately process the same output of a single unit." *See* Ex. 1018 ¶ 9.

Last, we disagree with Patent Owner's argument that Petitioner "uses impermissible hindsight to combine and merge various disparate embodiments from *Numazaki* in a manner *Numazaki* never contemplated."

PO Resp. 17 (citing Ex. 2002 ¶ 59). According to Patent Owner, such a combination would not have been obvious to one of ordinary skill in the art because Numazaki did not recognize it as a viable embodiment. *Id.* (citing Ex. 2002 ¶ 59). However, a reason to modify a reference does not have to originate from the reference being modified. The rationale for combining references can be gleaned from a variety of sources. *See DyStar Textilfarben GmbH & Co. Deutschland KG v. C.H. Patrick Co.*, 464 F.3d 1356, 1361 (Fed. Cir. 2006) ("The motivation need not be found in the references sought to be combined, but may be found in any number of sources, including common knowledge, the prior art as a whole, or the nature of the problem itself.").

Furthermore, we agree with Petitioner that Patent Owner's argument is unpersuasive in view of the Federal Circuit's finding that "two separate embodiments in a prior art reference rendered obvious the challenged claim where 'one of ordinary skill in the art would have been motivated to combine' them." Reply 10 (citing *Boston Sci. Scimed, Inc. v. Cordis Corp.*, 554 F.3d 982, 991 (Fed. Cir. 2009) ("*Boston Sci*"). Patent Owner attempts to distinguish *Boston Sci.*, arguing that

> the two prior art embodiments in *Boston Sci.* were "pictured side by side in the [prior art] patent . . . Figure 3B [] is located directly below figure 4 in the patent." *Boston Sci. at* 991 (emphasis added). The proximity of the two embodiments formed the basis for obviousness: "Combining two embodiments disclosed adjacent to each other in a prior art patent does not require a leap of inventiveness." *Id*. (emphasis added). In contrast, *Numazaki's* third embodiment and fifth embodiment "feature data generation units" are separated by more than 22 figures. *Compare* Ex. 1004, Fig. 23 *with* Ex. 1004, Fig. 46.

Sur-reply 7. Patent Owner also argues that Petitioner's reliance on *Boston Sci.* is misplaced because the proposed combination here is more complex than the modification at issue in *Boston Sci. Id.* at 7–8 (citing *Boston Sci.*, 554 F.3d at 991; Pet. 20–21; Reply 8–9; Ex. 2002 ¶¶ 58–59). These arguments are not persuasive because, although mentioning that the combined embodiments are shown in adjacent figures, the *Boston Sci.* decision does not require such proximity in order for one of ordinary skill in the art to have been motivated to combine embodiments. *Boston Sci.*, 554 F.3d at 991. Moreover, the *Boston Sci.* decision does not require that a proposed combination of separate embodiments be simple in order to be obvious. *Id.*

For the above reasons, we find on the complete record that Petitioner has demonstrated by a preponderance of the evidence that the combination of Numazaki and Nonaka discloses limitation [1(b)].

d) Limitation [1(c)]: "control the digital camera in response to the gesture performed in the electro-optical sensor field of view, wherein the gesture corresponds to an image capture command, and wherein the image capture command causes the digital camera to store an image to memory"

As discussed above, Petitioner asserts that one ordinary skill in the art "would have been motivated to implement [the third embodiment's] gesture recognition as a means of allowing the user to initiate (or turn on) the fifth embodiment's videoconferencing functionality" because, "pursuant to *Nonaka's* teachings, the user experience would be improved by allowing users to position themselves in place before the video camera and initiate video capture through a gesture, rather than a physical input or timer mechanism." Pet. 31. Petitioner also argues that Numazaki's fifth embodiment uses visible light photo-detection array 351 for taking video

images and image memory unit 352 for storing the video images. *Id.* (citing Ex. 1004, 39:32–35). Petitioner adds that the fifth embodiment processes the output of reflected light extraction unit 102 to identify an outline of the subject of the image and subtracts everything outside the outline to produce an extracted image without background information that is stored in extracted image memory unit 354. *Id.* 31–32 (citing Ex. 1004, 39:24–60, 40:32–35).

In response, Patent Owner argues that because "*Numazaki's* fifth embodiment discloses extracting faces of speaking persons for transmission via a 'TV telephone,'" one of ordinary skill in the art "would recognize that to dial the telephone number, the user must physically interact with *Numazaki's* laptop (e.g., keyboard), and thus the user would <u>*already*</u> be positioned 'in place' for the videoconference." PO Resp. 18 (citing Ex. 1004, 39:5–16; Ex. 2002 ¶ 62). Thus, Patent Owner argues, there is no motivation to modify Numazaki based on Nonaka's teachings because "[i]t would be redundant to require the user to then perform a gesture signaling that the user is 'in place' because such is already known to the laptop by virtue of the physical interactions," and one of ordinary skill in the art "would recognize that a user would be in reach of *Numazaki's* laptop before and during a videoconference enabled by *Numazaki's* laptop." *Id.* 18–19 (citing Ex. 2002 ¶¶ 62–63).

This argument is not persuasive for several reasons. First, Numazaki's fifth embodiment is not limited to a TV telephone as the disclosure refers to "the TV telephone, for example." Ex. 1004, 39:12–13. Thus, we are not persuaded that an ordinarily skilled artisan would necessary understand Numazaki's disclosure as requiring the user to dial a telephone number. Rather, we agree with Petitioner's argument, supported by Dr.

Bederson's testimony, that one of ordinary skill in the art would have understood that there are many scenarios in which a user would not be sitting in front of the laptop to initiate a videoconference, such as a lecturer standing for a lecture and a tutorial in which the speaker is demonstrating a product that requires a broader field of view than remaining seated before the camera. Reply 12–13 (citing Ex. 1018 ¶¶ 10–11).

Second, even if Numazaki does suggest that the user would need to be within reach to physically interact with the laptop, this does not mean that one of ordinary skill in the art would not have recognized the advantages of using remote gestures taught by Nonaka. An obviousness analysis "need not seek out precise teachings directed to the specific subject matter of the challenged claim, for a court can take account of the inferences and creative steps that a person of ordinary skill in the art would employ." *KSR*, 550 U.S. at 418; *see also id*. at 421 ("A person of ordinary skill is also a person of ordinary creativity, not an automaton.").

Next, Patent Owner challenges Petitioner's argument that one of ordinary skill in the art would have combined Numazaki's embodiments in the manner proposed to achieve a higher degree of freedom, good portability, and cost benefits as taught by Nonaka. PO Resp. 20. Specifically, Patent Owner argues that "*Nonaka* teaches that 'a higher degree of freedom, good portability, and cost benefits' are the results of ***not*** needing a remote-control unit to operate a camera," and "*Numazaki* is completely silent regarding the existence of remote-control units and the use of remote-control units to operate a camera." *Id.* (citing Ex. 1005, 2). Thus, in Patent Owner's view, Petitioner's reason for combining Numazaki's embodiments is based on solving a problem that Numazaki never had. *Id.* (citing Ex. 2002 ¶ 64).

We agree that Nonaka discloses that its gesture-based image capture functionality provides a higher degree of freedom, good portability, and cost benefits relative to a remote release operation that uses a transmitter or receiver. *See* Ex. 1005, 2:26–29. We disagree, however, that this disclosure would have only suggested to one of ordinary skill in the art *replacing a remote control unit* with a gesture-based image capture functionality. Rather, it is reasonable to conclude that one of ordinary skill in the art would have recognized that Nonaka's gesture-based image capture functionality was a desirable technique for triggering image capture in general.

Here, Petitioner takes that position, arguing that "*Nonaka* explains that *users desired the ability to remotely trigger image capture*, but that then-existing options were limited to self-timer mechanisms and expensive wireless remote controls—both of which were undesirable." Pet. 21 (citing Ex. 1006, 2:6-25) (second emphasis added); *see also* Reply 14 (agreeing with the Board's determination in the Decision on Institution) (citing Dec. Inst. 8). In other words, Petitioner relies on Nonaka as teaching the desirability of remotely triggering image capture *and* using gesture-based image capture functionality to do so. In addition, the Petition is supported by Dr. Bederson's testimony that "*Numazaki* does not teach a specific process for initiating the video capture as part of its fifth embodiment, but a [person having ordinary skill in the art] would have understood that this video capture process could be started using any of a number of standard methods for initiating a video," and "*Numazaki's* native functionality of associating hand gestures with commands would have been a natural fit as a means to initiate video capture." Ex. 1003 ¶ 49. We find this testimony persuasive on the full record. *See KSR*, 550 U.S. at 417 ("[I]f a technique has been used to improve one device, and a person of ordinary skill in the art

would recognize that it would improve similar devices in the same way, using the technique is obvious unless its actual application is beyond his or her skill.").

In addition, Patent Owner argues that "the Petition . . . fails to explain why gesture-based image capture initiation provides 'a greater degree of freedom' than timers, especially when a timer can be set for any length of time, giving the user whatever time is needed to get into position and get prepared for the video capture." PO Resp. 20 (citing Pet. 21–22; Ex. 2002 ¶ 65).

This argument is not persuasive because Petitioner is not required to show that the gesture-based image capture initiation provides a greater degree of freedom than timers. "'[T]he question is whether there is something in the prior art as a whole to suggest the *desirability,* and thus the obviousness, of making the combination,' not whether there is something in the prior art as a whole to suggest that the combination is the *most desirable* combination available." *In re Fulton*, 391 F.3d 1195, 1200 (Fed. Cir. 2004) (quoting *In re Beattie,* 974 F.2d 1309, 1311 (Fed. Cir. 1992)).

Last, Patent Owner challenges Petitioner's argument that one of ordinary skill in the art would have anticipated success in combining Numazaki's embodiments in the manner proposed. PO Resp. 21–22. Specifically, Patent Owner argues that "[t]he Petition seems to argue that the only difference between *Numazaki's* third embodiment (gesture detection) and *Numazaki's* fifth embodiment (TV telephone) is the addition of a 'video light photo-detection array' and thus combining *Numazaki's* third and fifth embodiments would be 'straightforward,'" but because Numazaki's third and fifth embodiments have different implementations with different specialized units, combining these embodiments would have entailed much

more than merely adding a video camera. *Id.* (citing Ex. 2002 ¶ 66). Patent Owner also argues that Numazaki's disclosure of using gestures to power appliances on and off does not guarantee success in combining Numazaki's embodiments in the manner proposed because an ordinarily skilled artisan would recognize that merely powering on an appliance such as a camera is different than invoking functions such as image capture. *Id.* at 22 (citing Pet. 24; Ex. 1004, 31:7–10, 31:35–44; Ex. 2002 ¶ 67).

These arguments are not persuasive. Instead, we agree with Petitioner that Patent Owner mischaracterizes and over-simplifies Petitioner's position in arguing that the only difference between the third and fifth embodiments "seems" to be the addition of the video light photo-detection array. *See* Reply 16–17. Indeed, although the Petition asserts that one of ordinary skill in the art "would have understood that adding a third image sensor to the portable laptop in support of the fifth embodiment's video capture functionality would have been straightforward" (Pet. 24), this is not the only basis for asserting that there would have been a reasonable expectation of success in making the proposed combination. The Petition also asserts that one of ordinary skill in the art "would have anticipated success in implementing *Numazaki* in this manner given that *Numazaki* already includes the technical hardware and programming necessary to detect gestures, associate gestures with commands, and capture video, and expressly contemplates incorporating these early-described embodiments in the eighth embodiment portable devices." Pet. 23 (citing Ex. 1003 ¶ 51).

We also agree with Petitioner that Patent Owner improperly argues that there is little "guarantee of success" rather than a reasonable expectation of success. *See* Reply 18. "Obviousness does not require absolute predictability of success . . . all that is required is a reasonable expectation of

success." *In re O'Farrell*, 853 F.2d 894, 903–04 (Fed. Cir. 1988) (citations omitted).

For the above reasons, we find on the complete record that Petitioner has demonstrated by a preponderance of the evidence that the combination of Numazaki and Nonaka discloses limitation [1(c)].

e) Conclusion

For the above reasons, we determine that Petitioner has shown by a preponderance of the evidence that the combination of Numazaki and Nonaka renders obvious claim 1.

4. Independent Claims 8 and 13

Independent claim 8 recites a computer implemented method having similar limitations as the device claim of claim 1. *Compare* Ex. 1001, 15:21–38, *with id.* at 16:1–13. For its analysis of claim 8, Petitioner refers back to its analysis of claim 1. Pet. 43–44. Similarly, independent claim 13 recites an image capture device having similar limitations as claim 1. *Compare* Ex. 1001, 15:21–38, *with id.* at 16:24–40. Petitioner also refers back to its analysis of claim 1 for its analysis of claim 13. Pet. 47–48.

Regarding claims 8 and 13, Patent Owner relies on the same arguments as those advanced with respect to independent claim 1 (PO Resp. 24–25, 27–28), which arguments we have found unpersuasive for the reasons discussed above. Accordingly, based on the complete record, we determine that Petitioner has shown by a preponderance of the evidence that claims 8 and 13 are unpatentable over Numazaki and Nonaka.

5. Dependent Claims 4, 11, and 18

Claim 4 depends from claim 1 and recites that "the electro-optical sensor is fixed in relation to the digital camera." Ex. 1001, 15:43–44. Claims 11 and 18 depend from claims 8 and 13, respectively, and similarly

recite that the electro-optical sensor is fixed relative to the digital camera. *Id.* at 16:17–19, 16:49–50. For this feature, Petitioner asserts that

> *Numazaki's* fifth embodiment positions an electro-optical sensor (i.e., []reflected light extraction unit 102) and digital camera (i.e., visible light photo-detection array 351) side-by-side such that they have overlapping fields of view. Indeed, *Numazaki* expressly teaches that "visible light photo-detection array 351 and the reflected light extraction unit 102 are arranged in parallel."

Pet. 38 (citing Ex. 1004, 39:4–44); *see also id.* at 47, 49 (asserting the same argument for claims 11 and 18). The Petition does not direct us to any expert testimony supporting this assertion.

In the Decision on Institution, we did not agree "that being arranged in parallel necessarily means that reflected light extraction unit 102 and visible light photo-detection array 351 are fixed relative to each other." Dec. Inst. 23. In its Response, Patent Owner argues that the portion of Numazaki cited by Petitioner for this feature does not contain any description of whether reflected light extraction unit 102 and visible light photo-detection array 351 are fixed with respect to each other. PO Resp. 23 (citing Ex. 1004, 39:4–44); *see also id.* at 26, 29 (making the same argument in connection with claims 11 and 18). Patent Owner also argues that one of ordinary skill in the art "would not interpret 'arranged in parallel' to necessarily mean that that 'reflected light extraction unit 102' and 'visible light photo-detection array 351' are fixed relative to each other." *Id.* at 23 (citing Ex. 2002 ¶ 71).

Petitioner replies by arguing that the fact that unit 102 and camera 351 have and must retain overlapping fields of view is key to concluding that they are fixed relative to each other. Reply 19–20 (citing Pet. 27–28). Petitioner also argues that Mr. Occhiogrosso admits, and Dr. Bederson confirms, that (1) "unit 102 and camera 351 must retain overlapping fields of

view in order to 'satisfy the intended purpose' of Numazaki's fifth embodiment;" (2) "that fixing unit 102 and camera 351 in relation to one another ensure that they retain overlapping fields of view;" and (3) there is no "teaching in Numazaki that suggests unit 102 and camera 351 are not fixed in relation to on another." *Id.* at 20 (citing Ex. 1019, 23:21–24:22, 25:7–14, 25:18–26:2; Ex. 1018 ¶¶ 13–15).

In the Sur-reply, Patent Owner argues that unit 102 and camera 351 having overlapping fields of view does not necessarily mean that they are fixed relative to each other. Sur-reply 11; *see also* Tr. 20:21–21:3 (using visual aids during the oral hearing to support contention that the fields of view can be overlapping despite relative motion of the structure). Patent Owner contends that Numazaki does not disclose unit 102 and camera 351 have or require identical fields of view. *Id.* (citing Ex. 1004, 39:20–60). Citing Mr. Occhiogrosso's testimony, Patent Owner also argues that only a partial overlap in the fields of view is needed to accomplish the goal of Numazaki's fifth embodiment and relative movement of unit 102 and camera 351 does not necessarily result in non-overlapping fields of view. *Id.* at 11–12 (citing Ex. 1019, 24:10–24).

We agree with Patent Owner that the Petition does not establish sufficiently that Numazaki's unit 102 and camera 351 are fixed relative to one another. Without more, the mere fact that unit 102 and camera 351 are arranged in parallel and have overlapping fields of view does not establish that the structures are fixed. At the oral hearing, counsel for Petitioner indicated that Petitioner's position was not an inherency argument but relied on Dr. Bederson's analysis and interpretation of Numazaki's fifth embodiment. Tr. 17:7–15. The Petition, however, does not reference any such analysis in connection with the subject matter of claims 4, 11, and 18.

Pet. 38, 47, 49. The portions of the Petition cited in the Reply (i.e., pages 27–28 of the Petition, which pertain to limitation 1[(a)]) discuss the overlapping fields of view but not assert that overlapping fields of view require the structures to be fixed with respect to one another.

For the foregoing reasons, we determine that Petitioner has not shown by a preponderance of the evidence that the combination of Numazaki and Nonaka renders obvious claims 4, 11, or 18.

6. Dependent Claims 2, 3, 5–7, 9, 10, 12, and 14–17

Petitioner provides reasonable and detailed explanations, supported by the testimony of Dr. Bederson, indicating where in the references the limitations of claims 2, 3, 5–7, 9, 10, 12, and 14–17 are disclosed. Pet. 33–43, 44, 47, 49. Further, Patent Owner offers no arguments particularly directed to these dependent claims. PO Resp. 22, 25, 28.

We have considered the evidence and arguments of record and determine that Petitioner has demonstrated by a preponderance of the evidence that the combination of Numazaki and Nonaka renders obvious claims 2, 3, 5–7, 9, 10, 12, and 14–17 for the reasons discussed in the Petition and as supported by the testimony of Dr. Bederson.

E. Asserted Obviousness Based on Numazaki, Nonaka, and Aviv

Petitioner argues that the combination of Numazaki, Nonaka, and Aviv renders obvious dependent claims 6, 12, and 17. Pet. 50–55. Patent Owner argues only that Aviv does not remedy the alleged deficiencies of Numazaki and Nonaka argued in connection with the independent claims. PO Resp. 28.

Because of our determination that Petitioner establishes by a preponderance of the evidence that claims 6, 12, and 17 would have been unpatentable over the combination of Numazaki and Nonaka, we do not

reach this alternate challenge to claims 6, 12, and 17. *See SAS Inst. Inc. v. Iancu*, 138 S. Ct. 1348, 1359 (2018) (holding that a petitioner "is entitled to a final written decision addressing all of the claims it has challenged"); *see also Boston Sci. Scimed, Inc. v. Cook Grp. Inc.*, 809 F. App'x 984, 990 (Fed. Cir. 2020) (nonprecedential) (stating that the "Board need not address issues that are not necessary to the resolution of the proceeding," such as "alternative arguments with respect to claims [the Board] found unpatentable on other grounds").

F. Jurisdiction over Expired Patents

Patent Owner argues that the USPTO does not have jurisdiction over expired patents. PO Resp. 1–2. Rather, Patent Owner argues, the USPTO only has jurisdiction over patents with claims that can be amended or cancelled. *Id.* Patent Owner states that, as explained by the Supreme Court, "Congress [has] significant latitude to assign [the] adjudication of public rights to entities other than Article III courts," including for the USPTO to "reexamine—and perhaps cancel—a patent claim in an inter partes review." *Id.* (quoting *Oil States Energy Servs., LLC v. Greene's Energy Grp.*, LLC, 138 S. Ct. 1365, 1368, 1374 (2018)) (alterations in original). However, Patent Owner argues that this authority does not extend to expired patents because the public franchise associated with an issued patent no longer exists after expiration. *Id.* at 2. Thus, it is argued, the USPTO no longer has jurisdiction, even though the patent owner "may be entitled to collect damages" for patent infringement, because "the patent owner[] no longer has the right to exclude others" and the USPTO has nothing to cancel or amend. *Id.*

Patent Owner reasons that:

> Expiration removes the patent from the [US]PTO's jurisdiction and returns it to the sole jurisdiction of the Article III courts, which have exclusive authority to govern claims for damages. If this were not so, the [US]PTO would purport to have authority to retroactively modify a public franchise that no longer exists, in a setting where the expired public franchise does not enjoy any presumption of validity and in which amendment of claims is no longer permitted.

Id.

Inter partes review of patents, whether expired or not, fits within the USPTO's mandate "for the granting and issuing of patents" (35 U.S.C. § 2(a)(1)), for as the Supreme Court has stated, "[i]nter partes review is 'a second look at an earlier administrative grant of a patent'" (*Oil States Energy Servs.*, 138 S. Ct. at 1374 (quoting *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144 (2016))). Our rules have also made clear *inter partes* review covers expired patents. 37 C.F.R. § 42.100(b); *see also, e.g.*, 83 Fed. Reg. 51341 (Oct. 11, 2018) (Changes to the Claim Construction Standard for Interpreting Claims in Trial Proceedings Before the Patent Trial and Appeal Board)[8] ("The claim construction standard adopted in this final rule also is consistent with the same standard that the Office has applied in interpreting claims of expired patents and soon-to-be expired patents. *See, e.g.*, *Wasica Fin. GmbH* v. *Cont'l Auto. Sys., Inc.*, 853 F.3d 1272, 1279 (Fed. Cir. 2017) (noting that '[t]he Board construes claims of an expired patent in accordance with *Phillips* . . . [and] [u]nder that standard, words of a claim are generally given their ordinary and customary meaning').").

Further, the statutes governing *inter partes* review do not limit them to non-expired patents. For example, 35 U.S.C. § 311(b), which sets forth the

[8] Available at https://www.federalregister.gov/d/2018-22006/p-13.

scope of *inter partes* review merely refers to patents, with no mention of the expiration date. Further, 35 U.S.C. § 311(c) entitled "Filing Deadline" makes no mention of the expiration date of the patent. Elsewhere, 35 U.S.C. § 315 does limit the filing of IPRs based on civil actions and the serving of complaints, but again makes no mention of the expiration date of the patent. Patent Owner does not identify any statute or legal precedent that expressly limits *inter partes* review to non-expired patents.

Patent Owner fails to adequately explain why the Patent Office's authority to take a second look at an earlier administrative grant of a patent ends when the patent term expires even though the rights granted by the patent are not yet exhausted.

For all of these reasons, we do not agree that the Board lacks jurisdiction over expired patents.

III. CONCLUSION

In summary:

Claims	35 U.S.C. §	Reference(s)/Basis	Claims Shown Unpatentable	Claims Not shown Unpatentable
1–18	103	Numazaki, Nonaka	1–3, 5–10, 12–17	4, 11, 18
6, 12, 17	103[9]	Numazaki, Nonaka, Aviv		
Overall Outcome			1–3, 5–10, 12–17	4, 11, 18

IV. ORDER

In consideration of the foregoing, it is hereby:

[9] As explained above, we do not reach this alternative ground.

ORDERED that claims 1–3, 5–10, and 12–17 of U.S. Patent No. 8,878,949 B2 are determined to be unpatentable;

FURTHER ORDERED that claims 4, 11, and 18 of U.S. Patent No. 8,878,949 B2 are not determined to be unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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US008878949B2

(12) **United States Patent**
Pryor

(10) **Patent No.: US 8,878,949 B2**
(45) **Date of Patent: *Nov. 4, 2014**

(54) **CAMERA BASED INTERACTION AND INSTRUCTION**

(71) Applicant: **Gesture Technology Partners, LLC**, Sylvania, OH (US)

(72) Inventor: **Timothy R. Pryor**, Sylvania, OH (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **13/961,452**

(22) Filed: **Aug. 7, 2013**

(65) **Prior Publication Data**

US 2014/0028855 A1 Jan. 30, 2014

Related U.S. Application Data

(63) Continuation of application No. 13/459,670, filed on Apr. 30, 2012, now Pat. No. 8,654,198, which is a continuation of application No. 12/891,480, filed on Sep. 27, 2010, now Pat. No. 8,189,053, which is a continuation of application No. 11/376,158, filed on Mar. 16, 2006, now Pat. No. 7,804,530, which is a continuation of application No. 09/568,552, filed on May 11, 2000, now Pat. No. 7,015,950.

(60) Provisional application No. 60/133,671, filed on May 11, 1999.

(51) **Int. Cl.**

H04N 5/232	(2006.01)
G06F 3/01	(2006.01)
G06F 3/038	(2013.01)
H04N 5/222	(2006.01)

(52) **U.S. Cl.**

CPC ***H04N 5/23296*** (2013.01); ***G06F 3/017*** (2013.01); ***G06F 3/0386*** (2013.01); ***H04N 5/222*** (2013.01); ***H04N 5/232*** (2013.01); ***H04N 5/23219*** (2013.01)

USPC **348/211.99**; 348/211.4

(58) **Field of Classification Search**

CPC .. H04N 5/23238; H04N 5/247; H04N 5/3415

USPC 348/211.4, 211.5, 211.8, 211.9, 222.1, 348/239

See application file for complete search history.

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(Continued)

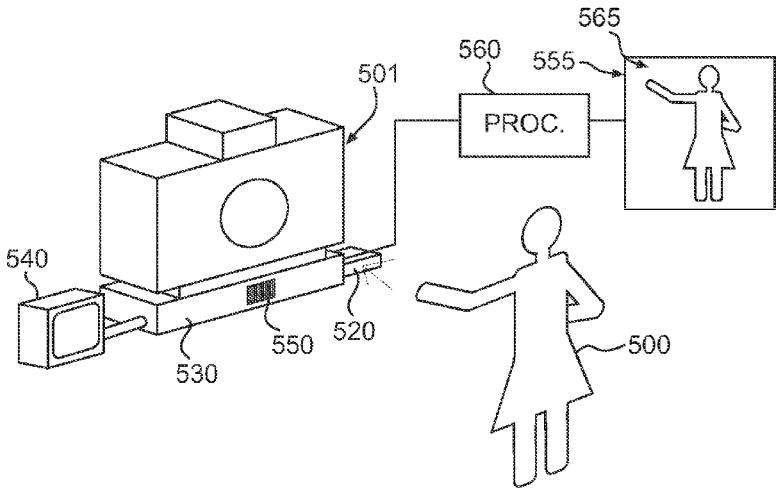
Primary Examiner — Tuan Ho

(74) *Attorney, Agent, or Firm* — Warner Norcross & Judd LLP

(57) **ABSTRACT**

Disclosed are methods and apparatus for instructing persons using computer based programs and/or remote instructors. One or more video cameras obtain images of the student or other participant. In addition images are analyzed by a computer to determine the locations or motions of one or more points on the student. This location data is fed to computer program which compares the motions to known desired movements, or alternatively provides such movement data to an instructor, typically located remotely, who can aid in analyzing student performance. The invention preferably is used with a substantially life-size display, such as a projection display can provide, in order to make the information displayed a realistic partner or instructor for the student. In addition, other applications are disclosed to sports training, dance, and remote dating.

18 Claims, 7 Drawing Sheets



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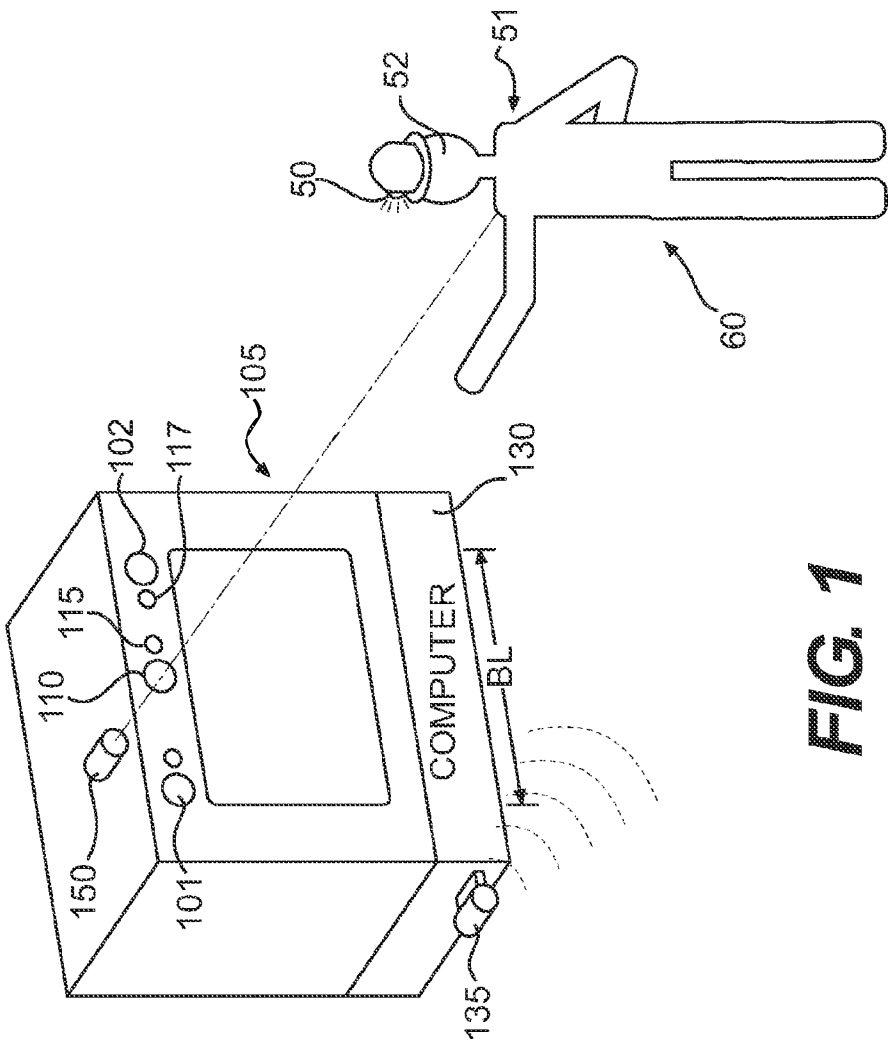


FIG. 1

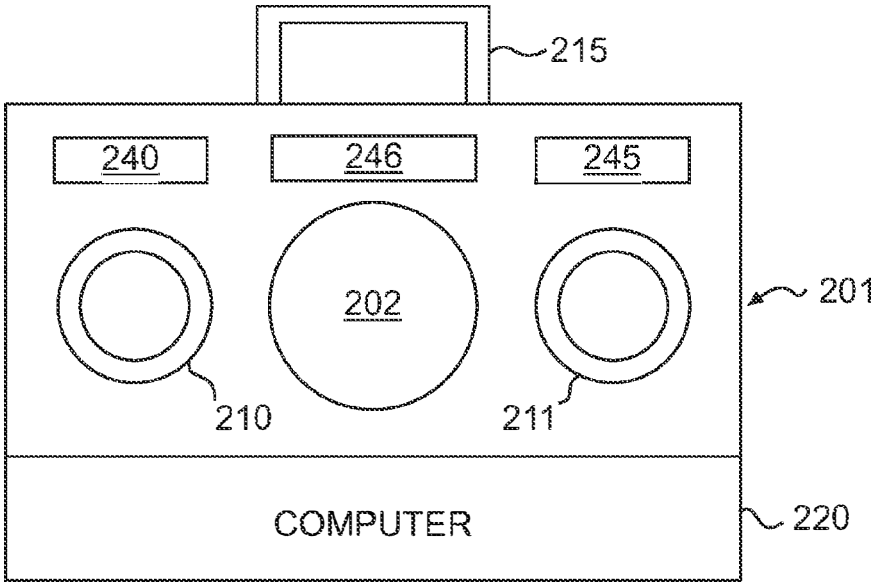


FIG. 2A

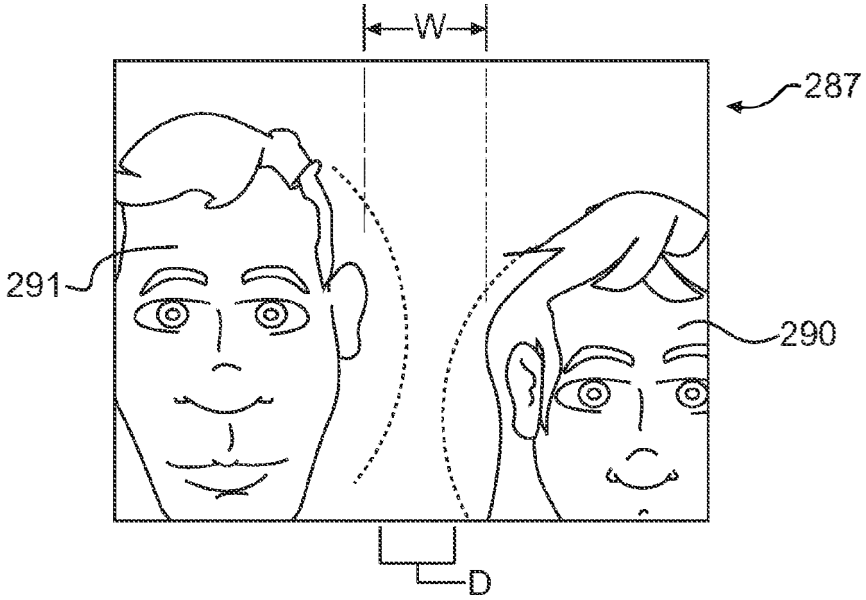
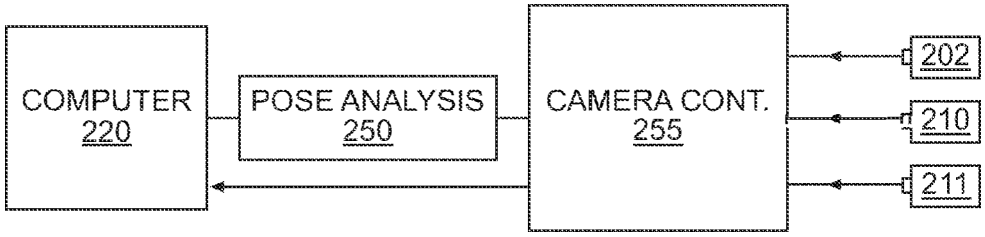


FIG. 2D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POSE ANALYSIS
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CAMERA CONT.
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211

FIG. 2B

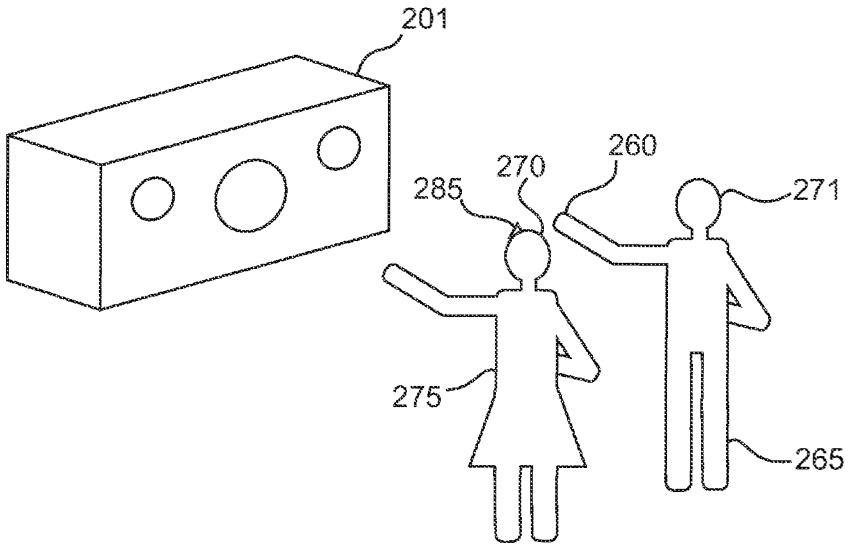
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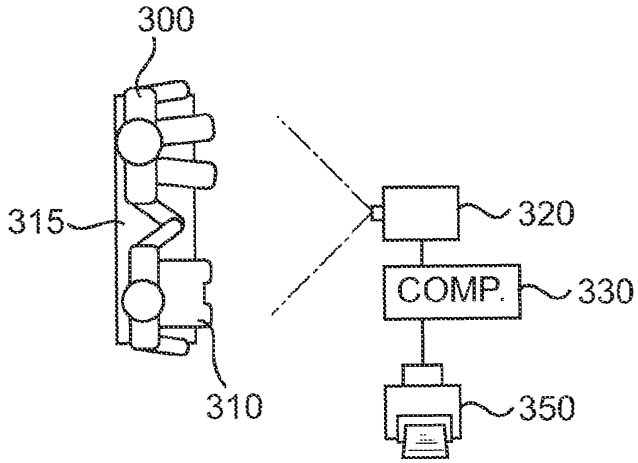
FIG. 2C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COMP.
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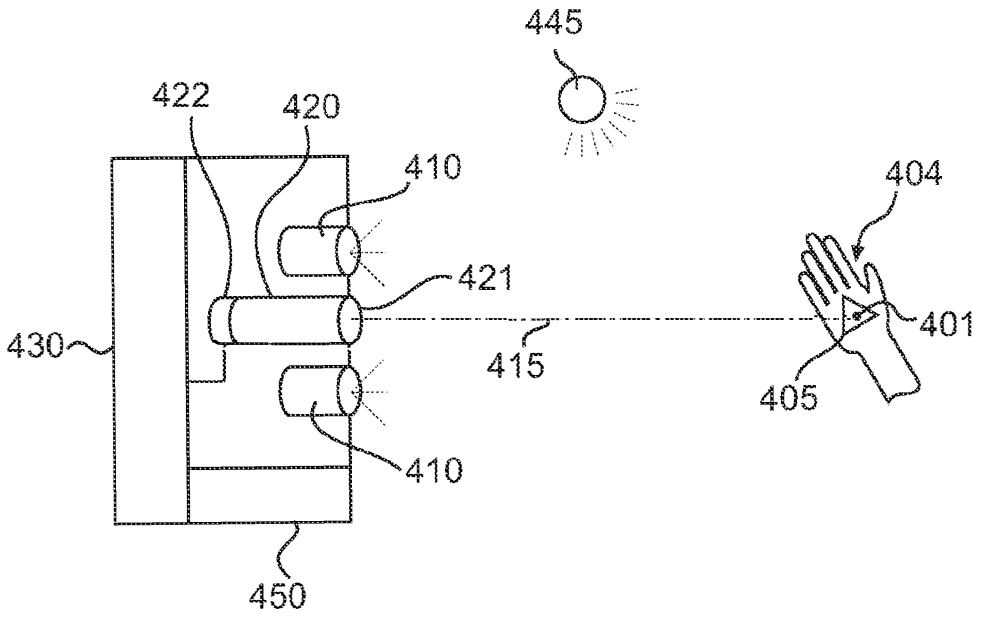
FIG. 3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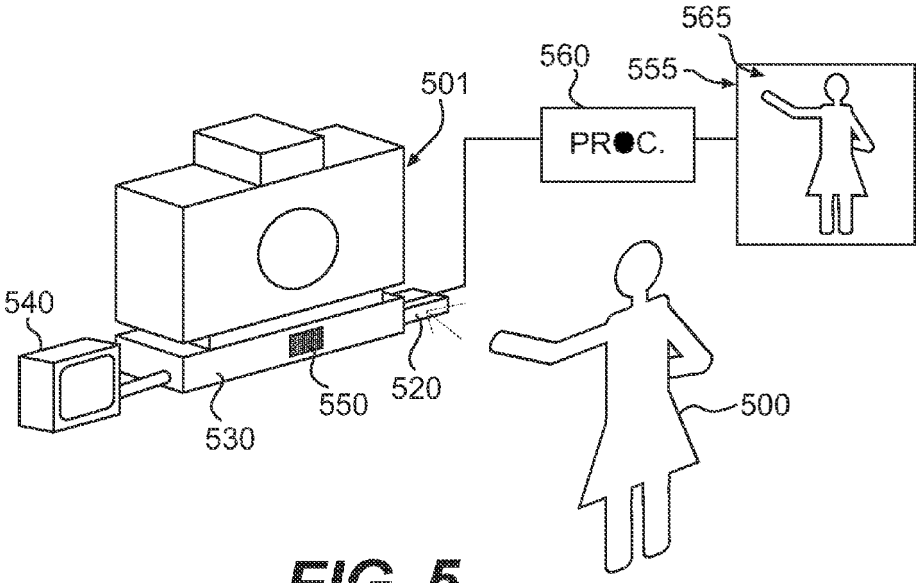
450

FIG. 4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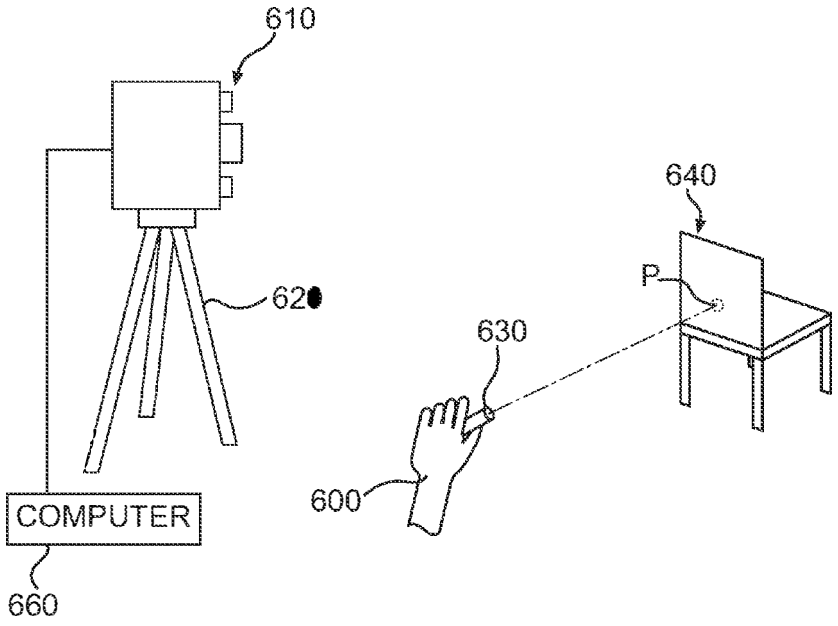
520
530
500

FIG. 5


610
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P
630
620
600
COMPUTER
660

FIG. 6

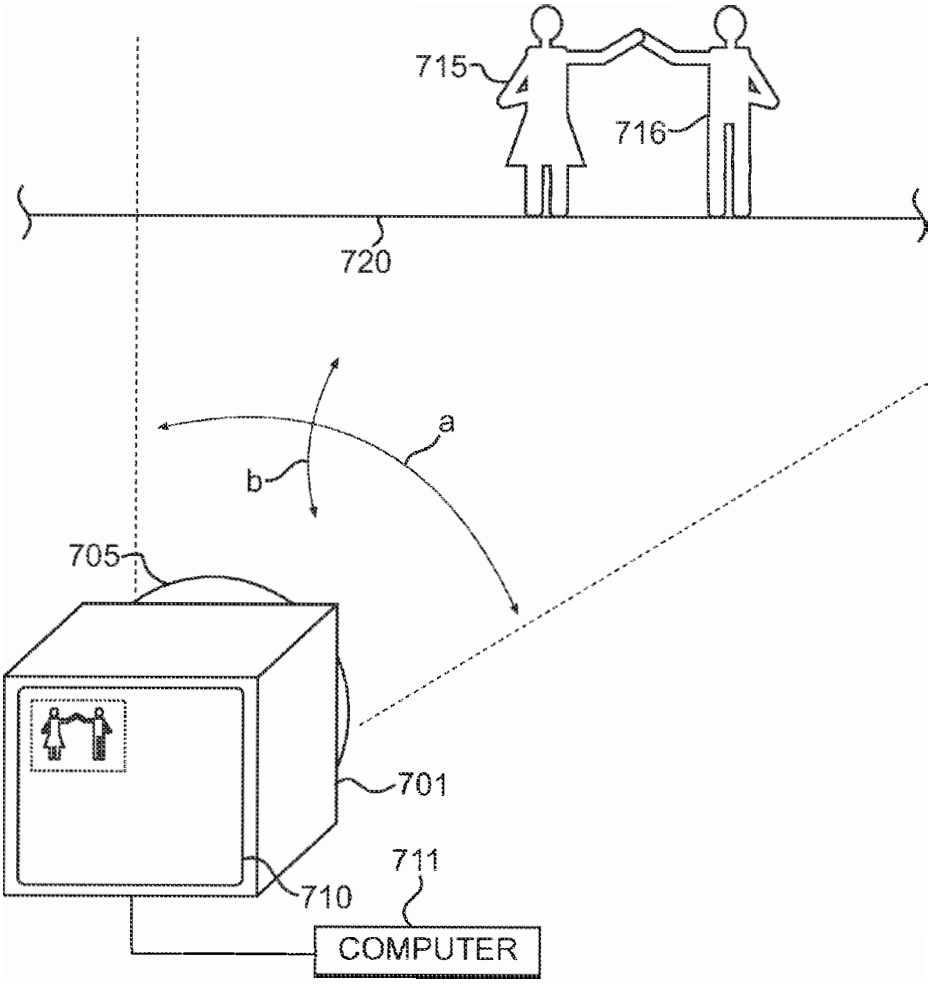

FIG. 7

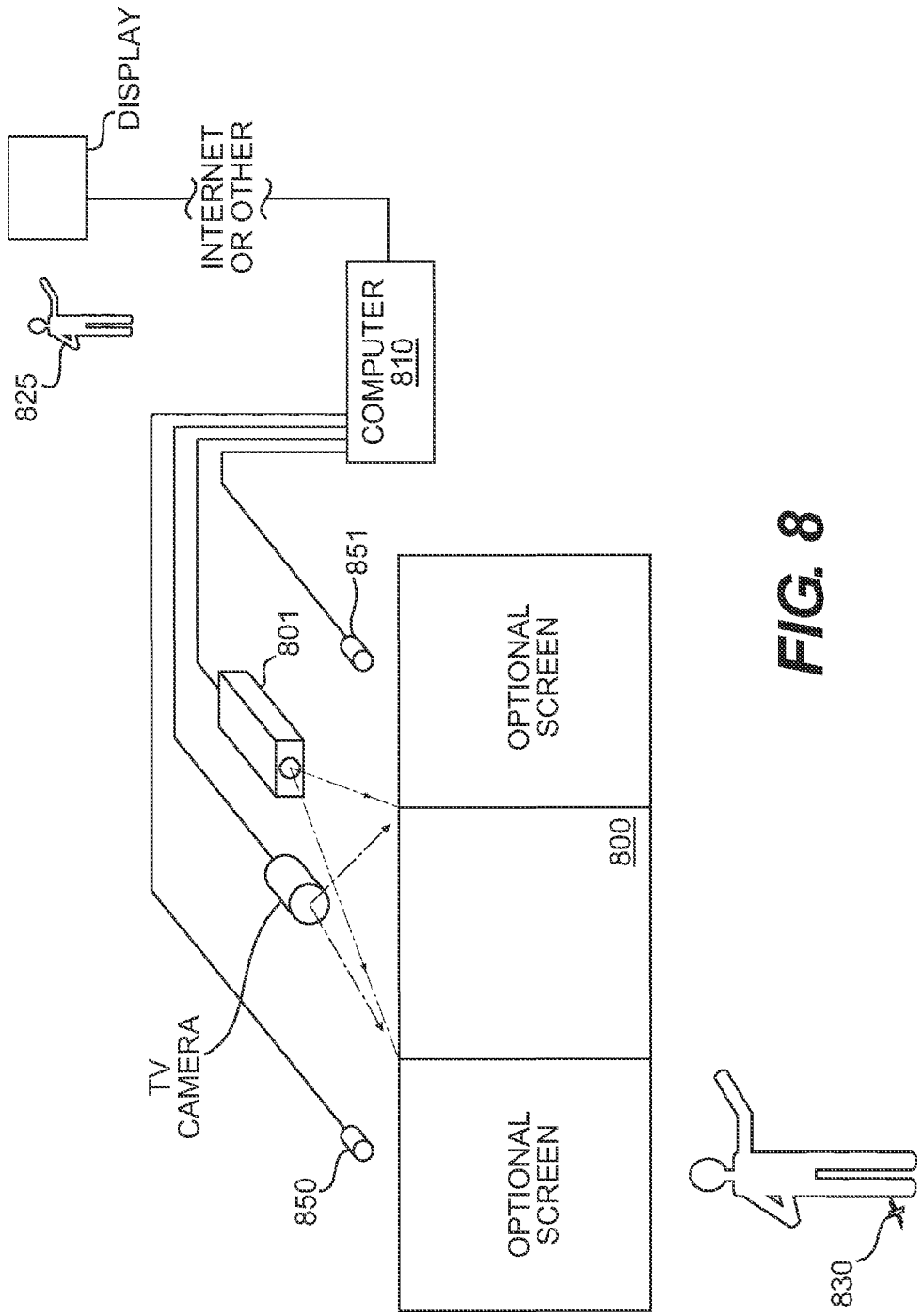
DISPLAY
INTERNET OR OTHER
COMPUTER 810
825
851
801
OPTIONAL SCREEN
800
OPTIONAL SCREEN
TV CAMERA
850
830

FIG. 8

CAMERA BASED INTERACTION AND INSTRUCTION

Method and apparatus are disclosed to enhance the quality and usefulness of picture taking for pleasure, commercial, or other business purposes. In a preferred embodiment, stereo photogrammetry is combined with digital image acquisition to acquire or store scenes and poses of interest, and/or to interact with the subject in order to provide data to or from a computer. Other preferred embodiments illustrate applications to control of display systems.

BACKGROUND

Representative of USA patents on Digital cameras are U.S. Pat. Nos. 5,534,921, 5,249,053 and many others which describe use of matrix array (CCD or otherwise) based cameras to take pictures of humans or other objects. The images taken are generally comprised of 400,000 or more pixels which are often compressed to smaller record sizes for data storage, for later retrieval and display. Video cameras or Camcorders are also increasingly able to take still photographs as well, and record or transmit them to computers.

Aside from exposure control (to keep the light reaching the detector array within the dynamic range of same), and range finding (to effect the best lens focus given the object distance in question) there are few cases known to the inventor where the camera taking the picture actually determines some variable in the picture and uses it for the process of obtaining the picture.

One such example that does not take a picture of humans but rather of data, is exemplified by U.S. Pat. No. 4,791,589, where a certain wave form signature on an oscilloscope is searched for by processing the digital camera image, and when it is seen, the image stored.

More apropos the function of "Picture Taking" as the general public knows it and of interest as the primary focus of the instant invention, is U.S. Pat. No. 5,781,650 by Lobo, et al which describes analysis after the fact of recorded images to determine facial content and thus the age of the subject. This disclosure also alludes to a potential point and shoot capability also based on the age classification of the individuals whose picture is desired.

There is no known picture taking reference based on object position and orientation with respect to the camera, or other objects that I am aware of.

SUMMARY OF THE INVENTION

High Resolution Digital still cameras employing matrix photodetector array chips to scan the image produced by the camera lens are now commonplace, and will be even more so in a few years as chips and memories become very inexpensive, and pixel density approaches 2000×2000 pixels, rivaling photographic film. Even today Camcorders having 700×500 pixel image chips are common for video based data and stills.

This invention is aimed at improvements in utilization of these cameras and others which make use of a computer based camera's ability to analyze, in real time if desired, the images obtained. Indeed a picture taking system may be composed of a combination of cameras, some used for purposes other than the recording of the picture proper.

It is a goal of the invention to provide a method for taking pictures when certain poses of objects, sequences of poses, motions of objects, or any other states or relationships of objects are represented. It is also a goal to allow this to be done in a self timer like mode, when desired scene situations or specific dates or other circumstances exist. In some cases, information as to what is desired may be entered remotely, even over the internet, or radio telephone.

It is also a goal of the invention to provide a method for selecting from a digital or other picture memory, pictures obtained when certain pre programmed poses of objects, sequences of poses, or relationships of objects are represented.

It is a further goal of the invention to provide means by which users engaged in digital camera based activities, or other activities, using a computer can have their pictures taken.

It is a still further goal to provide all such functions in a 2D or 3D context, and using simple equipment capable of widespread use.

It is another goal of the invention to feed back data to a subject or subjects having his or her, or their picture taken, in order that they assume another pose or engage in another activity, or juxtaposition of subject positions.

While this invention is primarily aimed at the general picture taking public at large, it is realized that commercial photographers and cine-photographers, for example in the coming trend to digital "Hollywood" movie making, may benefit greatly from the invention herein, as it potentially allows more cost effective film production by giving the director the ability to expose the camera to the presence of masses of data, but only saving or taking that data which is useful, and if desired, to signal the creation of further data based on data obtained. All this with little or no human intervention as desired, thus saving on the cost of direction, film crews, and other labor or venue related costs.

DRAWINGS DEPICTING PREFERRED EMBODIMENTS OF THE INVENTION

FIG. **1** illustrates means by which users engaged in digital camera based activities, or other activities, using a computer can have their pictures taken.

FIGS. **2A-2D** illustrate a method for taking pictures when certain pre programmed poses of objects, sequences of poses, or relationships of objects are represented.

FIG. **3** illustrates a self timer like mode, or when specific dates or other circumstances exist, including a system embodiment for taking pictures in shopping malls or other locales and providing instant print or other hardcopy capability (e.g. on a tee shirt).

FIG. **4** illustrates means to provide all such functions in a 2D or 3D context, using simple equipment capable of widespread use. Various retroreflective artificialtarget configurations are also disclosed.

FIG. **5** illustrates a method to feed back data to a subject having his or her picture taken, in order that the subject assumes another pose or engage in another activity.

FIG. **6** illustrates a commercial version of the invention useful for police departments and real estate agents, among others.

FIG. **7** illustrates an embodiment of the invention used for photography of stage performances.

FIG. **8** illustrates an embodiment of the invention used for ballet instruction and other teaching and interaction activities also with remotely located instructors or players.

EMBODIMENTS OF THE INVENTION

FIG. 1

Illustrated in FIG. **1** of the invention is means by which users engaged in digital camera based activities, or other

activities, using a computer can have their pictures taken, and in this context, FIG. **1** resembles that of co-pending referenced application 9 above. A single camera, or a set, such as a stereo pair are employed to see portions of an object, such as a person, a part of a person such as a hand, leg, foot, fingers, or head, and/or to view datums on an object, portion of an object, or an object held by the person or with which the person interacts. In addition, multiple persons and objects can be seen.

Where a single camera is employed, 2D measurements of object location relative to the camera (x and y perpendicular to the camera axis) are all that is possible, unless datums of known shape or spacing are used on the object viewed. Where a stereo pair or more of cameras are employed, 3D (xyz) data of a single point can be provided, for example retro-reflector **50** on the head **52** of person **51**. In both cases where 3 or more datums are used on an object, 6 Degree of freedom data can be obtained, allowing object orientation in 3 angular axes as well as range in 3 axes to be obtained. With two or more cameras, such 3D data may also be obtained using other features of objects such as edges of arms and the likely using known photogrammetric techniques.

The cameras used may also be used to take pictures of an object, or another specialized camera used for that purpose in conjunction with those used to determine the location of object features. Both examples are illustrated in this application.

As shown in this figure, two cameras **101** and **102** are used as a stereo pair, with each camera located at opposite sides of a TV monitor **105**, used for either computer or Television display or both. This is a desirable configuration commercially and discussed the co-pending application references above. In this particular case, an additional camera **110** is shown in the middle of the other two, said added camera used for picture taking, internet telephony and/or other purposes. An optional auxiliary LED light source **115** (or **116** or **117**) for illuminating a user **60** or other object is also shown.

All three cameras are connected to the computer **130** by means of a USB (Universal Serial Bus) daisy chain, or IEEE 1394 firewire connections (faster). Each is accessed, as needed for position and orientation determination, or picture taking.

Even using a single camera in two dimensions (as is normal today), some position and orientation data or sequences of same can be achieved using modern image processing techniques. (See for example the invention disclosed in U.S. Pat. No. 4,843,568 of Myron Krueger). However, accurate sensing and control of systems, such as cameras herein is difficult today with processors cost effective enough to be used by the public at large, and artificial target augmentation of image points is often desirable.

It is thus possible using the invention to be taking pictures of users of interactive computer systems for whatever purpose. This allows one to automatically capture images of children at play, for example with a computer system such as a computer game. It also enables many other functions which are described below. And it can be used in the field, where the computer, stereo position sensing and picture taking camera, may be co-located together in the same housing.

It is noted that where retro-reflectors are used, (as opposed to choosing for example less contrasting datums, for example natural object features such as edges of fingers, or clothing features, or targets such as colored dots) then each of the two cameras for stereo location determination needs lights to illuminate retro-reflectors substantially co-located with the camera axes. These lights can alternatively provide general lighting for any other camera or cameras to use in taking photographs or other purposes.

It is noted that cameras **101** and **102** need not have the image of the retro-reflector or other discernable target be in precise focus, indeed it is often helpful to have a some blur due to defocusing so as to aid sub pixel position solution of datum location. If the LEDs or other light sources are in the near infrared, and the camera lenses are focused in the visible, this occurs naturally, unless the lens is also near infrared chromatic corrected.

An optional laser pointer (or other suitable illumination source), comprised of diode laser and collimating optics **150** is also usable with the invention to illuminate object portions from which 3D data is desired (such as the neck region of person **51** as shown), or in the simpler case to designate which areas of a picture are to be focused, or zoomed in on or transmitted or recorded—with or without consideration of 3-D position data of the object. This can be fixed as shown, or optionally hand held by the user, for example in left hand (dotted lines) and used by him or her to designate the point to be measured in 3D location. (see also references above). In addition a person taking pictures, such as a photography can without looking through the viewfinder of the camera, point to appoint on the subject, which is then dealt with by camera typically by focusing the lens system such that the point is in the desired state of focus (usually but not necessarily when the laser spot on the subject appears smallest in diameter and/or of highest contrast). Such as system is particularly useful for cameras with wide fields of view, or those mounted on pan tilt mechanisms, where the mechanism can also be activated to position the camera axis to take the picture with the laser spot for example centered in the camera field.

In the laser designated case, it is generally the laser spot or other indication on the surface that is imaged, (although one can also instruct, for example using voice recognition software in computer **130** inputted via voice activated microphone **135**, the camera processor to obtain and store if desired the image of the area around the spot projected onto the object as well or alternatively), and if the spot is desired, it is often useful that cameras **101** and **102** have band-pass filters which pass the laser wavelength, and any led illumination wavelengths used for retro-reflector illumination for example, but block other wavelengths to the extent possible at low cost. It is noted that the discrimination in an image can also be made on color grounds—i.e. with red diode lasers and red LEDs, the system can analyze the image areas containing reds in the image, for example—with the knowledge that the answer can't lie at any shorter wavelengths (e.g. green, yellow, blue).

By using two cameras **101** and **102**, a superior ranging system for the laser spot location on the subject results, since the baseline distance "BL" separating the cameras for triangulation based ranging purposes can be sufficient to provide accurate measurement of distance to the object.

FIGS. **2**A-**2**D

As we begin to consider the apparatus of FIG. **1**, it is clear one could do much more to enhance picture taking ability than hereto fore described and contained in the prior art. And it can be done with apparatus capable of field use.

FIGS. **2**A-**2**D for example, illustrates a method for taking pictures when certain pre programmed or otherwise desired poses of objects, sequences of poses, or relationships of objects are represented. No such ability is available to photographers today.

Consider still camera system **201**, patterned after that of FIG. **1** and comprising 3 cameras and associated image scan-

ning chips. The central camera, **202**, is for picture taking and has high resolution and color accuracy. The two cameras on either side, **210** and **211**, may be lower resolution (allowing lower cost, and higher frame rate, as they have less pixels to scan in a given frame time), with little or no accurate color capability, as they are used to simply see object positions or special datum positions on objects (which may be distinguished however by taught colors for example as taught in some of my co-pending inventions).

Cost wise the distinction between cameras is important. Today low cost CMOS chips and lenses capable of the providing stereo measurements as described above are $15 or less. High quality CCD color detector arrays and lenses for high quality photo images are over $100, and in many cases $1000 or more.

An optical viewfinder **215** is one of many ways to indicate to the user what scene information is being gathered by the camera system. The user can in this invention specify with a viewfinder based readout, the area of the field that is desired. Use of the viewfinder in this manner, whether looked through or displayed on a screen, is for example an alternative to designating an area on the actual object using a laser pointer for the purpose.

The camera system **201** further contains a computer **220** which processes the data from cameras **210** and **211** to get various position and/or orientation data concerning a person (or other object, or persons plural, etc). Integral light sources as described in FIG. **1** above may also be provided such as LED arrays **240** and **245** and xenon flash **246**.

In general, one can use the system to automatically "shoot" pictures for example, when any or all of the following occur, as determined by the position and orientation determining system of the camera of the invention:

1. Subject in a certain pose.
2. Subject in a sequence of poses.
3. Portion of Subject in a sequence of poses (e.g. gestures).
4. Subject or portion(s) in a specific location or orientation.
5. Subject in position relative to another object or person.

For example, this could be bride and groom kissing in a wedding, boy with respect to cake on birthday, and sports events sequences of every description (where the camera can even track the object datums in the field and if desired adjust shutter speed based on relative velocity of camera to subject).

6. Ditto all of above with respect to both persons in certain poses or gesture situations.

7. When a subject undertakes a particular signal comprising a position or gesture—i.e. a silent command to take the picture (this could be programmed, for example, to correspond to raising one's right hand).

In addition it is noted that the invention acts as a rangefinder, finding range to the subject, and even to other subjects around the subject, or to all parts of interest on an extensive subject. This allows a desired lens focus to be set based on any or all of this data, as desired. It also allows a sequence of pictures to be taken of different objects or object portions, at different focal depths, or focus positions. The same holds true for exposure of these locations as well.

It is also possible to use the above criteria for other purposes, such as determining what to record (beyond the recording that is implicit in taking pictures), or in determining what to transmit. The latter is important vis a vis internet activity, where available internet communication bandwidth limits what can be transmitted (at least today). In this case video telephony with the invention comprehends obtaining only those images you really care about in real time. So instead of transmitting low resolution image data at 20 frames a second, you can transmit say 5 (albeit asynchronously gathered) frames of high resolution preferred data. (This doesn't solve flicker problems, but it does mean that poor quality or extraneous material isn't sent!). Criteria such as degree of image motion blur or image focus can also be used in making transmission decisions.

FIG. **2**B illustrates a block diagram showing a pose analysis software or hardware module **250** analyzing processed image data (for example utilizing camera image data processed by visionbloks software from Integral Vision Corp.) from the computer **220** (which may be the same physical microprocessor, such as a Intel Pentium 2 in a Dell inspiron 3500 laptop computer, or different) and determining from same when a certain pose for example has been seen. When this occurs, a signal is sent to the camera control module **255** to hold the last frame taken by camera **202**, and to display it to the photographer, digitally store it, or transmit it—to someone else, or another data store or display. Such transmission can be by data link, internet, cell phone, or any other suitable means.

Another criteria could be that two or more preselected poses were seen one after the other, with a time delay between them, also pre-selected if desired.

FIG. **2**C illustrates a specific case whereby a point on one person, say hand **260** of man **265** having head **271**, is determined, and a picture is taken by camera system **201** of the invention when this point comes within a distance of approximately 6 inches (or any other desired amount including contact—i.e. zero distance) from another person or object, say the head **270** of woman **275**. To obtain the data, one can look for hand or head indications in the image using known machine vision techniques, and/or in a more simple case put a target marker such as colored triangle **285** or other type on the hand or head or both and look for it.

The use of the natural features of the subjects heads, which are distinguishable by shape and size in a known field containing two persons, is now illustrated. For example, image morphology or template matching in the image field of the solid state TV camera **202** can be used to distinguish the head shapes from background data and data concerning the rest of the features such as hands, etc. of subjects **265** and **275** (or conversely hand shapes if desired can be found and heads excluded, or the hand of the right person, versus the head of the left, and so forth).

As shown in FIG. **2**D, when the image field **287** of camera **202** after processing contains the two head images, **290** and **291**, spaced a distance "W". When W is not within a tolerance D, the picture is not taken; whereas if the heads are close enough, within D as illustrated in dotted lines, the picture is taken.

Criteria as mentioned can include proximity of other parts of the body, or objects associated with the subjects (which themselves can be objects). In addition, the motion or relative motion of objects can be the criteria. For example, one could take program the device to take the picture when on two successive frames the condition shown in FIG. **2**D exists where the heads are apart in frame **1**, but closer in frame **2** (probably corresponding to a movement say of the boy to kiss the girl). Clearly other sequences are possible as well, such as movement taking place in several frames followed by a sequence of frames in which no movement occurs. Other means to determine motion in front of the camera can also be used in this context, such as ultrasonic sensors.

It is also noted that the actual position or movement desired can be "Taught" to the computer **220** of the picture taking system. For example, a boy and girl in a wedding could approach each other and kiss beforehand. The sequence of frames of this activity (a "gesture" of sorts by both parties) is

recorded, and the speed of approach, the head positions and any other pertinent data determined. When the photographer thinks the picture is right, the computer of the camera system is instructed to take the picture—for example it could be at the instant when after a suitable approach, two head images become joined into one—easily recognizable with machine vision processing software under uniform background conditions. Then in the future, when such a condition is reached in the camera field of view, pictures are taken and stored, or transmitted. This allows a camera to free run whose image field for example takes in the head table at a wedding party, taking only the shots thought to be of most interest. Numerous conditions might be programmed in, or taught in—another at the same party, would be anyone at the head table proposing a toast to the bride and groom, with arm and glass raised. If video is taken, it might be taken from the point at which the arm rises, until after it comes down. Or with suitable voice recognition, when certain toast type words are heard, for example.

Application to "3-D" Pictures

Where it is desired to take "3-D" pictures, it can be appreciated that each camera, **210** and **211** can take images of the scene in place of camera **202**, and that both cameras **210** and **211** outputs can be stored for later presentation in a 3D viewing context, using known display techniques with appropriate polarized glasses or switchable LCD goggles for example. In this case the camera outputs can serve double duty if desired, each both recording picture data, as well as determining position of one or more points on the object or objects desired.

In addition, or alternatively, one can use in this 3D picture case, the camera **202** (or even a stereo camera pair in place of **202**) as a means for determining position and orientation independently from the stereo picture taking cameras.

If not used for immediate position information, camera **202** does not have to be digital and could employ film or other media to record information.

FIG. **3**

In a manner resembling that of FIGS. **2**A-**2**D above, the invention can also serve to aid a person to take his or her own picture—a modern "Self timer" if you will. For example any or all of the criteria such as the items 1-7 above, can be used as criteria for the picture to be taken of oneself. This is in addition to other more normal things like taking pictures after a certain time, or on a certain date or time interval, etc. This has particular appeal for taking pictures of one's self, or in any other situation where the photographer is not present (e.g. unattended recording of animals, children, etc.). Similarly, a hand signal or other signal to the camera can be used to trigger the picture to be taken, using the computer camera combination to determine the hand position or movement. This can also be done by voice using microphone input and suitable voice recognition software in the computer.

Today, in a conventional context, one can as a photographer, choose to shoot a fashion model or other subject, and when you see a pose you like record the picture. But as one's own photographer, this is much more difficult, unless you stream in video and search through the poses after the fact. But even then, you don't know that the poses were what was desired, as no feedback exists during the shoot.

With the invention, you may program the system to take only those poses which you think you want to get. And it can instruct the subject, when a picture is taken (and the lack thereof indicating to do something different to obtain the desired effect resulting in a picture). The effect desired can be changed in midstream to adjust for changing wants as well, by changing the program of the computer (which could be done using hardware switches, inserting a disc, or otherwise entered as a command). In addition, as mentioned above, the gesture or pose desired, can be taught to the system, by first photographing a variety of acceptable positions or sequences, and putting bounds on how close to these will be accepted for photographing.

A specialized case is shown in FIG. **3**, for self taking instant picture or printout device for use in a shopping mall Kiosk or other venue. In this case two sweethearts **300** and **310** are on a bench **315** in front of the digital or other camera **320**. When the computer **330** detects from processing the image (or images) of the invention that their faces are in close proximity (for example using the centroid of mass of their head as the position indicator, or even facial features such as described in the Lobo et al patent reference), the computer then instructs the camera to record the picture. A push button or other selector on the device allows the subjects to select what criteria they want—for example when their heads are together for 5 seconds or more, or not together, or hands held, or whatever. Or when their faces are within a certain distance criteria, such as one inch.

Alternatively, camera **320** may be a video camera and recorder which streams in hundreds or even thousands of frames of image data, and the selection of a group is made automatically by the invention in rapid fashion afterwards, with the subjects selecting their prints from the pre-selected (or taught as above) images as desired. Or the machine itself can make the final selection from the group, sort of as a random slot machine for pictures so to speak, and print the picture using inkjet printer **350** for example. Such a situation could be provided at less cost for example, with an incentive to add in your own criteria for an extra cost, and get pictures to choose from more along the lines desired. Note that in addition to, or instead of prints, they could have magnetic or other machine readable media to take home too.

FIG. **4**

FIG. **4** illustrates means to provide all such functions in a 2D or 3D context, using simple equipment capable of widespread use.

For example, the simplest case is to use the same single camera such as **110**, to both take the picture, and to determine location, according to the invention, of one or more points on the object or objects for purposes of controlling the picture taking, recording, or transmission process in some way.

As has been disclosed in the aforementioned referenced co-pending applications, one can view using the single camera, one or more such points in two dimensions, or in three dimensions under certain conditions when spaced points on the object have known spacing between them on the surface of the object.

Identifying points from raw images is processing intensive, as is determination movement gestures of such images, such as an image of an arm or hand in a varying clothing and background situations. But determining the location or movement of one or more artificial targets such as a colored retro-reflector is easy, accurate and fast, based on brightness (under substantially coaxial illumination) and color—and possibly shape as well if the target is of some distinguishable shape.

For example, consider retro-reflector (e.g. glass bead Scotchlight 7615 tape by 3M company) **401**, on the hand of a subject **404**, the retro-reflector having a red reflection filter **405** matched to the wavelength of the LEDs **410** used with

(and angularly positioned on or near the axis **415** of) camera **420** comprising lens **421** and detector array **422** used to take the picture of the object desired. When it is desired to determine the position of the hand **404**, the red LED's are turned on by camera controller **430**, and a bright reflection is seen in the image at the point in question due to the retro-reflection effect.

Where stereo pairs of cameras are used, as in FIG. **1** or **2**A, two reflections are seen whose disparity in location from one camera to the other gives the z distance (range direction) from the camera. In this case light sources are located with each camera of the stereo pair in order that for each camera, the retro-reflectors are properly illuminated with light emanating from point or points angularly near the camera in question.

The LEDs can be illuminated on alternate camera frames, or at any other time when "picture" type image data is not desired. In this case the camera does not under room lights **445** say, normally see the retro-reflection signal, which is desirable as the bright spot of **401** from the image of the human desired. Processor **450** processing the data, can even be used to subtract out from the recorded image, the shape of the retro-reflector, which might be a noticeably different shape than found in practice (e.g. a triangle). The image can be filled in where the subtraction occurred with color, brightness, contrast and texture or other characteristics of the surroundings. This is particularly easy if the target (retro-reflector or otherwise) is placed on the human or object in a region of small variation in characteristics needed to be filled in, e.g. the back of one's hand, say. The key is that after processing, the image look like it did without addition of the artificial target.

If the LEDs are turned on by the camera controller during picture taking, color processing can be used to remove from the stored image of the scene, any indications of bright zones at the LED wavelength used, filling in with color of the surrounding area as desired.

Clearly both processing techniques just described or others can be used. And the methods work well with stereo pairs of cameras too.

Retro-reflective or other distinguishable artificial targets can be provided in different decorative designs for wrist, back of hand, rings, forehead, hats, etc. For example, 3 targets in a heart or triangle shape, a square box of 4 targets, or a box or pyramid with line targets on its edges, and so forth.

Colored targets can be made of cloth, plastic, or the like, including Colored plaids, polka dots, etc. Or coatings or Filters or evaporated on filters may be placed in front of a target such as a plastic retroreflector in order to render it of a given color (if it wasn't made of colored material in the first place).

Decorative line outlines (also possible in retroreflective bead material) can also be used as target datums, for example down the seam of glove fingers, or shoes, or belts, dress beading, etc.

FIG. **5**

FIG. **5** illustrates further one of many methods by which the invention may be used to feed back data to a subject (or subjects) having his or her picture taken, in order that the subject assume another pose or engage in another activity.

For example consider FIG. **5**. A girl **500** is having her picture taken by the camera of the invention **501** (in this case a single digital camera version such as illustrated in FIG. **4**), and her positions, orientations or sequences of same, including motions between points are analyzed as described above, in this case by computer **530**. The computer has been programmed to look for funny movements and positions, defined here as when the arms are in unusual positions (clearly a subjective issue, programmed as to tolerances, or taught to the system by the person in control of the situation).

The girl then poses for the camera. When the camera of the invention takes the picture according to its preprogrammed criteria (in this case, for example, defined as when her arms are over her head, and after a significant movement has occurred), it lets her know by lighting light **520** connected by wires not shown to computer **530**. During the photo shoot, then she begins to learn what it is looking for (if she hasn't been already told) and does more of the same. If desired, and optional video display **540** or voice out put speaker **550**, both connected to computer **530**, indicate to her what is desired. This could also be a particular type of pose, e.g. "Cheesecake" based on historic classical poses learned from photo art (note that she can also make comments for recording too, with optional microphone input not shown. As pointed out above, voice recognition software, such as IBM Via Voice" can be used to recognize commands from the subject or photographer, and cause other results).

It can be more sophisticated yet. For example, if the computer **530** and any associated software as needed may be used to analyze the model's lips and her smile. In this manner, the invention can be used to photograph all "smiling" poses for example. Or poses where the smile is within certain boundaries of lip curvature even. Similarly, the camera or cameras of the invention can be used, with suitable image analysis software to determine when the subject's eyes are open a certain amount, or facing the camera for example.

FIG. **3** above has alluded to possible use of the invention data processing to determine position and/or orientation data from recorded picture frames, after the picture is taken. A method for selecting from memory pictures obtained when certain pre programmed poses of objects sequences of poses, or relationships of objects are represented.

Selection can be according to criteria for example 1-7 above, but there are some differences. First if the data is taken normally from a single camera such as that of **202** above, 3D information is not available. This being the case, conventional 2D machine vision type image processing (e.g. "Vision Bloks" software from Integral Vision Corp.) can be used to extract object features and their locations in the images retained.

A second version alternatively could employ a single picture taking camera, but by employing 3 dot or other suitable targets on the photographed object in the camera field, could calculate 3D data related to the object (position and orientation in up to 6 axes can be so calculated by the computer of the invention using target location data in the camera image field) .

A third version, records data from the camera, or in the case of the FIG. **2**A device, all three cameras—all recorded for example on digital media such that the processing can be done after the fact, just as it would have been live.

Another application can be to monitor the relative change in successive pictures as seen by one or more relatively low resolution cameras and when such change is minimal, cue the high resolution camera requiring a longer exposure to become enabled. In this manner blur of the high resolution camera image is avoided. This is useful in taking pictures of children, for example. This comparison of images can be made without actually measuring distances, but rather by looking for images which are not different within an acceptance band, one to another, thus indicating the motion is largely stopped. This can be determined by subtracting one image from the other and determining the amount of pixels

above a threshold. The more, the less the images are alike. Other techniques can be used as well, such as correlation techniques.

In some instances it is desirable to have, in taking pictures, a display such as **555**, preferably (but not necessarily) life size. This display can be not only used to display the image **565** of the person whose picture is being taken, but as well can display still (or video) images called up from computer memory or other media storage such as DVD discs, and the like. One use of the displayed images is to indicate to the subject a desired pose for example. This can be done by itself, or interactively using the invention. A computer generated and rendered 3D image can also be created using suitable 3D solid modeling software (such as CAD KEY) to show an approximate pose to the model.

For example the invention disclosed above, allows one to automatically observe the expressions, gestures and continence of a person, by determining the shape of their smile, the direction of eye gaze, and the positions or motion of parts of the body such as the head, arms, hands, etc. Analysis using pre programmed algorithms or taught sequences can then lead to a determination as to what information to display on display **555** controlled in image content by display processor **560**.

As one instance, suppose computer image analysis of data from camera **501** of the invention has determined that the person **500** is not smiling enough, and is in too stationary a pose. A signal from computer **510** is provided to display processor **560** so as to display on display **555** an image of someone (perhaps the same subject at an earlier time, or a computer generated likeness of a subject) having the characteristics desired. The person looks at this display, and sees someone smiling more for example, and in one scenario, tries to mimic the smile. And so forth. Alternatively, voice generation software, such as included in IBM VIAVOICE can be used to computer generate a voice command, "Smile More" for example, rather than show a visual illustration of the effect desired.

FIG. **6**

Let us now discuss some other applications of picture taking enabled by the invention. One embodiment can be used to determine location of items in a scene, for example furniture in a house, for which homicide studies or insurance fraud could be an issue (see also FIG. **1** above, as well as referenced co-pending applications).

For example, a detective (whose arm **600** is shown) arrives at a murder scene in a room, and he sets the stereo camera **610** of the invention disclosed in FIG. **2**C on a tripod **620** (or other suitable location) and systematically designates, using laser pointer **630**, any object desired, such as chair **640** impacted by the laser beam at point P. The camera/computer system of the invention locates the designated point takes a picture of the room, or a portion thereof, including the zone of the designated point P which stands out in the picture due to the laser spot brightness. Optionally, the stereo pair of cameras of the invention can digitize rapidly the xyz coordinates of point p, which can be superposed if desired on the image of the scene including point p itself and its immediate surroundings. This data can be processed by computer **660** as desired and either recorded or transmitted to a remote location along with the images as desired using known communication means. This work can be done outdoors, as well as inside. Numerous points to be digitized can be sensed and/or indicated, as desired.

The same digitization procedure can be used to digitize a room for a real estate person for example, to develop a data base on a house for sale. And many other such applications exist.

Finally it should be noted that the invention solves many famous problems of picture taking, for example of children. The digital camera images of the invention can be processed for example using appropriate software such as Vision Bloks to determine if the child's eyes are open (determined for example by recognizing the eye iris in the face area), and if so to take the picture, or after the fact, to select the picture from a group. Or a signal can be given by the system to the child to "open your eyes" so to speak. To determine if the eye is open, the image can be processed for example to look for the white of the eye, or to look for red reflections from the eye. This can even be done with deep red, or near IR light sources like LEDs which do not bother the child.

Similarly, if the child (or other subject) is in motion, when you want him still, the picture can be analyzed until he is still, and then the picture taken or selected. This can be determined from comparison of successive frames, from motion blur or other characteristics of motion in the image. Or a signal as above can be given to the child to "sit still" (a famous command in picture taking annals).

FIG. **7**

The invention can also be used for commercial photography and for producing motion pictures. One advantage is that very high resolution images at suitable exposure levels of critical scenes can be taken, but not too many which would overload the memory capacity of a camera system. A means to enhance this is now described.

It is noted that a camera having an ability to read individual pixels as desired, or at least to choose the lines of pixels to be read, can achieve high rates of scan if one knows apriori where to look apriori for data. Or if one say scans every 20th pixel in either direction xy of the camera, to determine where frame to frame changes are occurring (due to change in pixel brightness or color). Once change is determined one can often isolate those areas to the ones of interest. For example, even in a "Still" picture, the head often moves (similar to the lovers on the bench in the shopping mall mentioned above). Every 20th pixel, cuts the number of pixels by 400 times, and raises a normal 30 hz scan rate to over 1000 scans per second—more than needed in many cases.

When the area of interest is found, the pixels in that area are all scanned for example.

Such pixel addressing cameras can also be used for determining the position and change in position of features used to determine, and track, pose and other variables, as has also been discussed in co-pending applications, particularly Camera Based Man-Machine Interfaces U.S. Ser. No. 60/142,777, incorporated herein by reference. Of special interest is that same high resolution camera can be used to take the picture desired, while at the same time be used to find or track the object at high speed.

Such high speed tracking can be interspersed with the taking of pictures. For example if in photographing a ballet, it may be desired only to take pictures of the prima ballerina, who typically is the one, with any male dancer, that is moving the most. By determining the zone to be measured, one can sense quickly what zone should looked at, and high resolution photographs obtained from that zone. This allows one to use a very large format camera in a fixed location (e.g. 5000×5000 pixels) to cover the image of the whole stage via suitable optics, but to only take and store the pixels in a 1000×700

zone of interest movement, or positional or gesture interest for example, providing a 35 times increase in the frame rate needed today with such large pixel cameras. This allows their practical use, without resort to human cameramen, or pan/tilt mechanisms.

Similar logic holds for quarterbacks in a football game, who often run faster than any defense men around them and can be differentiated accordingly (along with any other issues such as uniform color, design or the like). If possible, it is desirable to have a clearly defined target, such as a retroreflective or bright colored target on one's helmet for example. Indeed helmet color can be chosen accordingly.

This is illustrated in FIG. **7** wherein camera **701** composed of lens **705** and an addressable version of a Kodak MegaPixel detector array **710** having 4000×4000 elements and under the control of computer **711** is used to scan the image of a pair of dancers **715** and **716** on stage **720**. The field of view of the camera equal to area ab covers the whole stage. But the area scanned out from array **710** is confined to the region in which the dancers were last seen, which is defined as a zone a'b' equal to in this case 500×500 pixels. This still allows DVD type resolutions to be achieved, without pan or tilt of the camera. Similarly such techniques can be used for video conferencing, sports, and other activities as well.

It should be noted that in the above embodiments the words picture and photograph are interchangeable, as are photographing or photography and picture-taking. The camera used for same is preferably but not necessarily a solid state TV camera whose pixels are scanned serially or randomly under program command.

FIG. **8**

The invention can also be used to sense positions of people for instructional purposes. Data as to a dancer's movements for example can be obtained, and appropriate images, or data or both transmitted without excessive bandwidth requirements to a remote location for comment or interaction by a trained professional. Combined with life-size screen displays this allows a life like training experience to be gained at low cost, since one professional can watch 10 students in different locations say, each trying her movements alone in the intervening moments. In addition such training can occur in the home, as if one had a private tutor or coach.

For example consider FIG. **8**. A class of ballet students is practicing near a "mirror" which in this case is comprised life size digital display screen **800** illuminated from the rear by a Sharp brand projector **801** driven by computer **810**. By sliding a real mirror in an out the mirror can be a mirror, or a display. If desired, this display can be extensive, and for example using 3 projectors to cover 3 adjacent screens each 6 feet high×9 feet long for example, such that a total length of a large studio is comprised.

A master instructor **825** (possibly remotely located via the internet or other communication means) can observe the students via TV camera (or cameras). By viewing the students the instructor can make corrections via audio, or by calling up imagery which represents the appropriate moves—for example from a professional doing the same Swan Lake number. In addition, the TV cameras of the invention can monitor the actual location and movements of the student, or students, and their relationship to each other, and if desired to various markers such as **830** on the floor of the studio, placed there to assist in choreographing the piece.

In addition, if the various gesture and position monitoring aspects of the invention are utilized as described above and in co-pending applications it is possible to have the instructions computer generated using dancers movements as input to a computer analysis program. This is particularly useful if dance routines which are classical in nature, are being attempted, which have known best forms which can be computer modeled.

In another version, an assistant can be on the scene say working with ten students in a local studio, while the master is remote.

It is also possible with the invention to provide input image data to projector computer **810**, even from remote internet located sources, which represents other people dancing for example. These can be images of the master, or others in the class—even if all in different locations. OR the images can be those of others who have performed a particular routine in the past, for example Dance of the Sugar plum fairy in the Nutcracker. This imagery could be from the Bolshoi ballet performance of the same dance, displayed in small town ballet studio or home—to illustrate the moves required. The use of life size projection not only gives a feel to this imagery, but further allows, I have discovered, a unique experience for the performer. Namely that the person can perform "with" the troupe displayed. In some cases, in ballet for example, this sometimes can be more useful than watching one's self in the mirror (typical in ballet studios).

By using the cameras of the invention, such as stereo pair **850** and **851** to determine student positions, it is also possible to control the display in many ways. For example as the student got closer to the display, the persons in the display could appear to come closer to the student. Conversely, it might be desirable to have them move away from the student to keep a constant apparent distance between them for example. And if the student is twirling left, the figures in the ballet depicted on the screen can be caused to turn right (as they are "in the mirror" so to speak) to match the movement of the student in approximate form at least.

In addition it is often desirable for learning purposes to Control speed of music and video display to match sensed movements of pupil, or from remote master person. Use display techniques which can produce variable motion display, such as variable speed DVD disc or read data in to ram. In addition it is desirable that overlaid could be masters voice.

The invention can be advantageously used in many performing arts, not just ballet. For example, live theatre, where actors from Hamlet performances of the past can interact with those practicing. Or where instructors of Skating or Gymnastics, other activities can also interact.

Sports as well is amenable to the technique, but the size of the "studio" or gym becomes an issue. Basketball for example fits the space aspect of the projection screens and the fields of view of the invention cameras as here described.

Ability of masters remotely located, and use of copyrighted performance material of famous performers and troupes allows one to franchise the studio concept of the invention. For example each town could have a Bolshoi studio franchise of this type.

It is noted that this same arrangement can serve other purposes beyond instruction. One is the possibility of remote dating, in which sensed movement of one partner is communicated, along with voice and visual expression to the other. In addition, is possible, as disclosed in co-pending applications, to build the displays described above in the form of a touch screen in which contact of one partner with the display of the other remotely transmitted from afar can occur.

If one uses large scale touch screens with optional added sensor inputs. As would be the ballet studio example of FIG. **8** if equipped with touch screen capability, then one can provide a mechanism for marketing of people relative (i.e. life

size) objects such as automobiles in facilities such as Auto showrooms. Thus a ballet studio for example, can be used for other purposes, not just instructional, but for selling cars for example, where the display screen is displaying new models (including ones that are figments of design imagination, and where customer input is desired as in a focus group) and where customer inputs voice and action can be detected if desired by the invention. Or in reverse, an underused car showroom can be converted—on demand—into a site which can be used for, among other things, instructional purposes in performing arts, sports and the like. This gives a reason for being to the show room that transcends selling cars, and helps attract people to the facility. If a car was displayed, on a touch screen, one could walk up to the full size display of the car, and touch the door handle, which would cause the touch screen to sense that same had occurred, and indicate to the computer to cause the display to display the door opening to expose the interior.

The invention claimed is:

1. A portable device comprising:

a device housing including a forward facing portion, the forward facing portion of the device housing encompassing an electro-optical sensor having a field of view and including a digital camera separate from the electro-optical sensor; and

a processing unit within the device housing and operatively coupled to an output of the electro-optical sensor, wherein the processing unit is adapted to:

determine a gesture has been performed in the electro-optical sensor field of view based on the electro-optical sensor output, and

control the digital camera in response to the gesture performed in the electro-optical sensor field of view, wherein the gesture corresponds to an image capture command, and wherein the image capture command causes the digital camera to store an image to memory.

2. The portable device of claim **1** wherein the determined gesture includes a hand motion.

3. The portable device of claim **1** wherein the determined gesture includes a pose.

4. The portable device of claim **1** wherein the electro-optical sensor is fixed in relation to the digital camera.

5. The portable device of claim **1** further including a forward facing light source.

6. The portable device of claim **1** wherein the electro-optical sensor defines a resolution less than a resolution defined by the digital camera.

7. The portable device of claim **1** wherein the electro-optical sensor includes at least one of a CCD detector and a CMOS detector.

8. A computer implemented method comprising:

providing a portable device including a forward facing portion encompassing a digital camera and an electro-optical sensor, the electro-optical sensor having an output and defining a field of view;

determining, using a processing unit, a gesture has been performed in the electro-optical sensor field of view based on the electro-optical sensor output, wherein the determined gesture corresponds to an image capture command; and

capturing an image to the digital camera in response to the determined gesture corresponding to the image capture command.

9. The method according to claim **8** wherein the determined gesture includes a hand motion.

10. The method according to claim **8** wherein the determined gesture includes a pose.

11. The method according to claim **8** wherein the electro-optical sensor includes first and second sensors in fixed relation relative to the digital camera.

12. The method according to claim **8** wherein the electro-optical sensor defines a resolution less than a resolution defined by the digital camera.

13. An image capture device comprising:

a device housing including a forward facing portion, the forwarding facing portion encompassing a digital camera adapted to capture an image and having a field of view and encompassing a sensor adapted to detect a gesture in the digital camera field of view; and

a processing unit operatively coupled to the sensor and to the digital camera, wherein the processing unit is adapted to:

detect a gesture has been performed in the electro-optical sensor field of view based on an output of the electro-optical sensor, and

correlate the gesture detected by the sensor with an image capture function and subsequently capture an image using the digital camera, wherein the detected gesture is identified by the processing unit apart from a plurality of gestures.

14. The image capture device of claim **13** wherein the detected gesture includes a hand motion.

15. The image capture device of claim **13** wherein the detected gesture includes a pose.

16. The image capture device of claim **13** further including a forward facing light source.

17. The image capture device of claim **13** wherein the sensor defines a resolution less than a resolution defined by the digital camera.

18. The image capture device of claim **13** wherein the sensor is fixed in relation to the digital camera.

* * * * *

CERTIFICATE OF COMPLIANCE

The brief complies with the type-volume limitation of Fed. Cir. R. 32(b)(1) because this brief contains 10,667 words, excluding the parts of the brief exempted by Fed. R. App. P. 32(f) and Fed. Cir. R. 32(b)(2).

This brief complies with the typeface requirements of Fed. R. App. P. 32(a)(5) and the type style requirements of Fed. R. App. P. 32(a)(6) because this brief has been prepared in a proportionally spaced typeface using Microsoft Word for Microsoft 365 in Century Schoolbook 14-point font.

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